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APPENDIX
TO
THOMPSON'S VERMONT

1853

A.R.193

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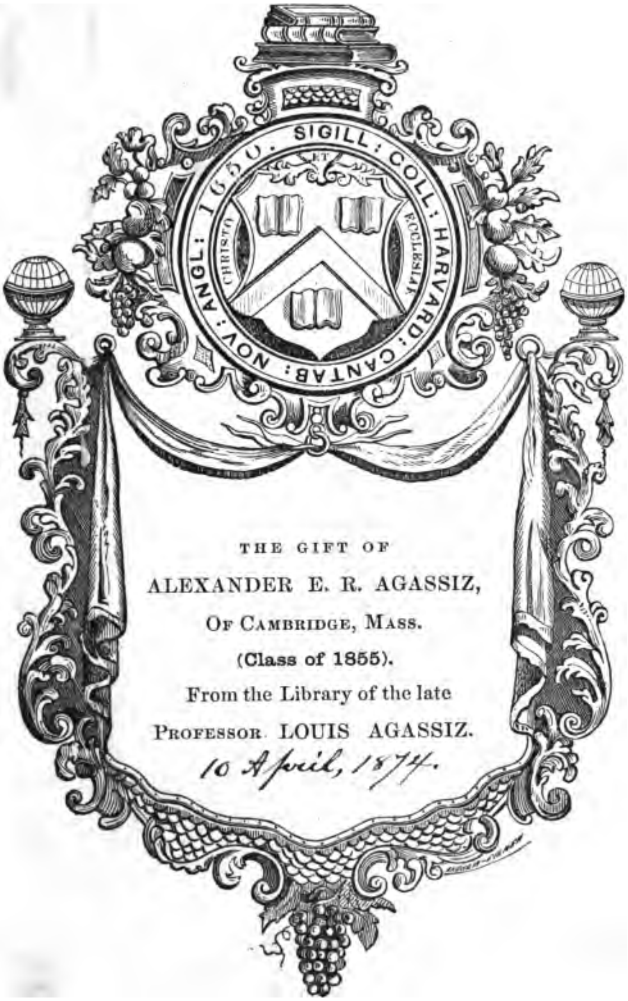
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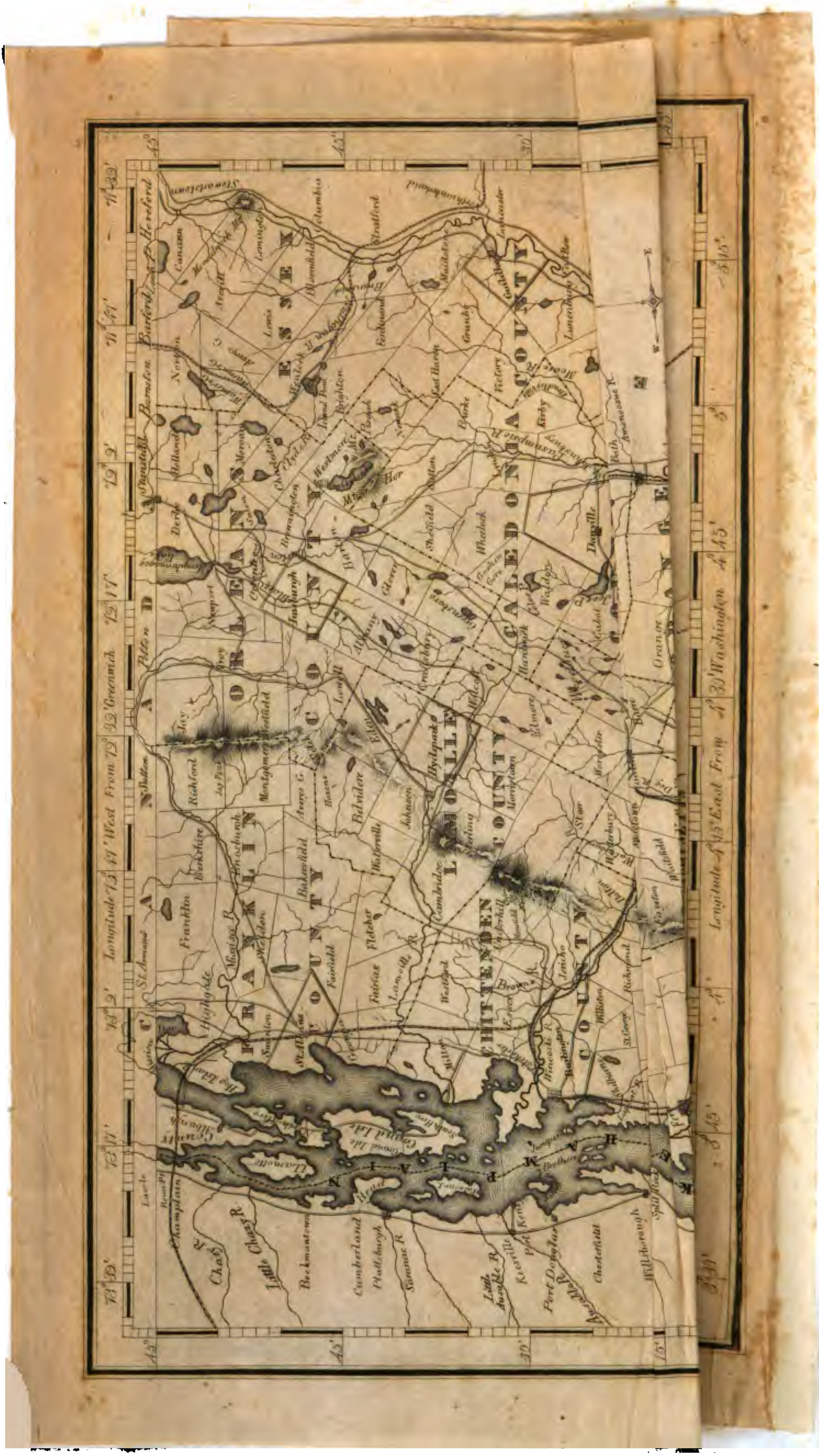
CHRISTO ET ECCLESIAE

THE GIFT OF
ALEXANDER E. R. AGASSIZ,
OF CAMBRIDGE, MASS.
(Class of 1855).
From the Library of the late
PROFESSOR LOUIS AGASSIZ.
10 April, 1874.

Prof. L. Agassiz
with respects of
Z. Thompson


Longitude 73° 41' West From 72° 32' Greenwich
Longitude 4° 45' East From 4° 30' Washington
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C A N A D A
Stewartstown
Hereford
Canaan
Barford
Norton
Barnston
Stanstead
Derby
Potton
Sutton
St. Armand
Alburgh
Champlain
Rouses Pt.
Lacole
ORLEANS COUNTY
ESSEX
CALEDONIA COUNTY
FRANKLIN COUNTY
LAMOILLE
CHITTENDEN COUNTY
ORANGE
Lemington
Columbia
Bloomfield
Brunswick
Maidstone
Lunenburg
Guildhall
Lancaster
Stratford
Northumberland
Granby
Victory
Kirby
Burke
East Haven
Newark
Brighton
Island Pond
Westmore
Charleston
Morgan
Holland
Lewis
Averill
Newport
Coventry
Irasburgh
Barton
Glover
Sheffield
Wheelock
Walden
Danville
Cabot
Hardwick
Greensboro
Craftsbury
Albany
Lowell
Eden
Hydepark
Johnson
Morristown
Elmore
Woodbury
Calais
Worcester
Middlesex
Waterbury
Stowe
Mansfield
Jay
Richford
Jay Peak
Montgomery
Troy
Westfield
Berkshire
Enosburgh
Bakersfield
Belvidere
Waterville
Cambridge
Sterling
Underhill
Jericho
Richmond
Bolton
Williston
Essex
Westford
Fairfax
Fletcher
Fairfield
Franklin
Highgate
Swanton
St. Albans
Georgia
Milton
Colchester
Burlington
Shelburne
St. George
Hinesburgh
Charlotte
Grand Isle
South Hero
North Hero
Isle La Motte
Hog Island
L. CHAMPLAIN
Juniper I.
Peru
Beekmantown
Chazy R.
Little Chazy R.
Plattsburgh
Cumberland Head
Saranac R.
Little Ausable R.
Keeseville
Port Kent
Port Douglass
Chesterfield
Willsborough
Split Rock
Lamoille R.
Missisque R.
Onion R.
Clyde R.
Passumpsic R.
Ammonoosuc R.
Connecticut R.
Moose R.
Lake Memphremagog
Mt. Monadnock
Mt. Pisgah
Mt. Hor
Bath
Orange
Dog R.
Moretown
Duxbury
Waitsfield
Fayston
N
S
E
W

APPENDIX

TO THE

HISTORY OF VERMONT,

NATURAL, CIVIL AND STATISTICAL,

1853.

BY ZADOCK THOMPSON.

Burlington:
PUBLISHED BY THE AUTHOR.
STACY & JAMESON, PRINTERS.
1853.

~~H332.3a~~

US 12050.1.2

1874, April 10.
Gift of
Alexander E. R. Agassiz,
of Cambridge, Mass.
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PREFACE.

A little more than ten years have now elapsed since the publication of my Natural, Civil and Statistical History of Vermont. In that work I endeavored to collect and present as concisely and clearly as I was able, and, at the same time, as fully as the state of knowledge and my prescribed limits would permit—

I. An account of the Natural History of the State, embracing its physical geography, zoology, botany and mineralogy.

II. The Civil History of the State, comprehending the settlement of the territory, the organization of the government, and the progress of legislation and improvement, together with a full account of the controversy with New York, the negotiations with the British in Canada, and of our various political, literary and religious institutions.

III. A Historical and Statistical Gazetteer, embracing a full account of all the counties, towns, streams, &c., in the State, arranged in alphabetical order.

Since the publication of that work, rail roads and the magnetic telegraph have been introduced into the State, and very considerable changes have taken place. A Geological Survey of the State has been commenced, but was discontinued, without any full publication of the results; in consequence of which, the greater part of the discoveries made and the facts elicited, have been lost to the State and the world; while a very small additional appropriation in 1847, would have secured to the State a Final Report on the Geology of Vermont, which would have been not only creditable to the State Geologist, but an honor and treasure to the State. But notwithstanding the loss, which has been occasioned, by this penny wise and pound foolish policy of the legislature, our general knowledge of the geology, and of the mineralogical productions of the State, has been greatly enlarged by the information elicited and made public during the continuance of the survey.

During the last ten years, I have spent a large portion of my time in collecting and preserving facts in relation to the natural and civil history of the State, thinking that the time might possibly come, when I should be warranted in the publication of a new and improved edition of the whole work. But the new materials having largely accumulated, and the number of copies of the original work, on hand, being such as to afford no encouragement for a speedy republication of the entire work, I concluded to select some of the principal items into the form of an Appendix, which might be bound with the remaining copies of the original work, and also be bound separately for those who already have the original work and desire the Appendix.

The matter of the Appendix will be found, to belong almost entirely, to the department of Natural History. This is not owing to any lack of materials for making additions to the other parts, but because those materials could not be so conveniently used in their separate condition. Additions to a work of this nature are, necessarily, fragmentary; and to be used advantageously, they must be incorporated by re-writing the whole. But as this could not be done without reprinting the whole, I have selected, for the Appendix, such materials as I thought would be most interesting and useful in their separate state; and these, for the most part, relate to Natural History.

Since the publication of my work in 1842, much light has been thrown upon the early history of our State by the antiquarian researches of Henry Stevens, Esq., and facts have been developed, which remove the mystery from certain transactions in our revolutionary struggles. But the introduction of these matters into the Appendix would require a repetition of much of the history of that period, to make it intelligible, and, consequently, more room than can be spared for it.

The history of our legislation during the last ten years, if fully written, would furnish an interesting and instructive chapter; but that, too, is excluded for the want of room. Perhaps the most important acts of legislation within the time, are those which relate to schools and the sale of alcoholic liquors. But, these several acts have not yet been fully tested by experience. The general school law of 1845, appeared to have been drawn with much care, and to promise an efficient provision for the advancement of primary education in the State, and it is to be regretted that it had not been more fully tested, before it was mutilated by repeals and additional enactments; and was violated by the body which enacted it, by their neglect to appoint a State Superintendent of Schools. But in spite of all obstacles, I am happy in believing that the cause of education is advancing, and that one of the most efficient causes of this advancement in our large villages, is the establishment of Union Schools. These schools furnish to the children of the poor the same advantages which are enjoyed by those of the rich, for pursuing the higher branches of study, and thus afford a universal stimulus in all the classes in the several schools, which form the union.

To almost every article in the Gazetteer, alterations and additions might be made, but, for the reasons already stated, it was deemed inexpedient. If life and health should be spared for a few years longer, it would afford me much satisfaction to re-write the whole work, and, by incorporating in it the additional material, make it more worthy of the approval and patronage of my fellow citizens, but, as the great expense would preclude me from the possibility of being able to publish a new edition, that satisfaction is not likely to be realized.

Z. THOMPSON.

Burlington, April 9, 1853.

APPENDIX

TO

THOMPSON'S VERMONT.

NATURAL HISTORY

Topography.

When the History of Vermont, to which this is an Appendix, was published, in 1842, the boundary line between the United States and the British provinces was unsettled, and in dispute between the two governments; but in the latter part of the summer of that year, the matter was amicably arranged by a treaty, formed by Mr. Webster and Lord Ashburton, and ratified by the two governments. The northern boundary of the state was intended to be along the 45th parallel of latitude, and was supposed to be on that parallel till the survey of 1818 proved the 45th parallel to be some distance to the southward of what had been previously regarded as the northern boundary of the state, cutting off a strip through the whole width, varying from one-fourth of a mile to a few rods. By the treaty, the northern boundary of the state was established upon the old well known line, without reference to the 45th parallel. This line was marked in 1845, by cutting away the timber, where it passed through forests, and by putting up cast iron posts at short distances through its whole length.

The geological explorations and the railroad surveys, which have been made during the last ten years, have added much to our knowledge of the general topography of the state, and many objects of interest and value have been brought to light. Remeasurements have been made of several of our principal mountain summits, and their altitudes ascertained with greater accuracy, probably, than before, and a number of important peaks have, within that period, been measured for the first time.

In addition to these measurements of isolated mountain summits, there have been reconnoisances and surveys made, in almost every direction, through the state, for the location of the various railroads which have been built, or are now building. The profiles of these roads, together with the profiles of the canal routes, which had been surveyed previously, have furnished the means for giving a very tolerable exhibition of the elevation above the sea, of the principal places and most interesting objects in the state.

In the following list of altitudes, those of mountain summits are all derived from Barometrical measurements. The others are in part Barometrical; but they are derived principally from the various surveys for canals and railroads. Minute accuracy in these altitudes above the sea, cannot be expected. They are, however, believed to be a near approximation to the truth, and to show with sufficient exactness the relative elevation of the different places and objects.

ALTITUDES ABOVE THE OCEAN.

Mountain Summits.

			Feet.
Chin,	Mansfield,	Thompson,	4348
Nose,	"	"	4044
South Peak,	"	"	3882
Camel's Hump,	Duxbury,	"	4083
Jay Peak,		Adams,	4018
Shrewsbury Peak,			4086
Killington "	Sherburne,	Partridge,	3924
Equinox,	Manchester,	"	3706
Ascutney,	Windsor,	"	3320
Snake Mt.,	Bridport,	Adams,	1310
Buck Mt.,	Waltham,	"	1035
Sugar Loaf,	Charlotte,	Thompson,	1003
Snake Hill,	Milton,	"	912
Cobble,	"	"	827

Passes over the Green Mountains.

Lincoln,		Adams,	2415
Granville,		"	2340
Peru,		"	2115
Sherburne,		Partridge,	1882
Walden,		De Witt Clinton,	1615
Mt. Holly,	(R. Road)	Gilbert,	1415
Roxbury,	(R. Road)		997
Williamstown,		Johnson,	908

Villages.

Burlington Town House,	Benedict,	202
" University,	"	367
Milton Falls,	Thompson,	298
Essex,	"	452
Jericho Corners,	"	604
Underhill Flat,	"	665
Williston,	"	402
Franklin,	"	430
St. Albans,	"	370
Highgate Springs,		160
Swanton,		160
E. Berkshire,		460
Winooski Falls,		203
Sheldon,		375
Richmond,		332
Waterbury,		425
Middlesex,		520
Montpelier, (Capitol,)		540
Northfield, (Depot,)		724
Braintree,		732
West Randolph,		678
Bethel,		556
Royalton,		476
White River Junction,		335
Windsor,		288
Bellows Falls,		225
Woodstock,		400
Brattleborough,		160
Bennington,		432
Manchester,		650
Rutland,		500
Castleton,		475
Ludlow,		985
Proctorsville,		895
Chester,		670
Brandon,		460
Middlebury,		390
Vergennes,		225
Norwich,		400
Newbury,		420
Barnet,		460
St. Johnsbury,		585
Lyndon,		735
Barton,		953
Derby Centre,		975
" Line,		1050
Craftsbury Common,		1158
Troy, south,		740
Irasburgh,		875
Hardwick Hollow,		720
Hydepark,		560
Cambridge,		410
Johnson,		460

Lakes and Ponds.

Champlain, Lake,*		90
Memphremagog "		695
Joe's Pond,	Cabot,	1544
Lyford's Pond,	Walden,	1692
Molley's Pond,	Cabot,	1626
Winooski Pond,	Peacham,	1410
Wells River Pond,	Groton,	1000
Crystal Pond,	Barton,	933
Mud Pond,	Sutton,	1183
Savanna Pond,	"	1210
Willoughby Lake,	Westmore,	1161
Elligo Pond,	Craftsbury,	893
Salem Pond,	Salem,	967
Pensioners Pond,	Charleston,	1140
Island Pond,	Brighton,	1182
Lake Connecticut, head of Con. River, in N. H.,		1589

Falls.

Great Falls, Marshfield, (head,)	1074
" " (foot,)	871
Nat. Bridge Falls, Waterbury, (foot,)	345
McIndoe's Falls, Barnet, (head,)	449
" " " (foot,)	436
20 Miles Rapids, Lunenburg, (head,)	822
" " Barnet, (foot,)	486
Guildhall Fall, Guildhall, (head,)	835

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*The level of Lake Champlain is taken for a basis in many of the surveys, which have been made, for canals and railroads, and their profiles indicate the height of places above the lake. In estimating, from these, the heights above the ocean, for the accompanying tables, 90 feet are added. The mean height of the lake above the ocean is frequently stated at 94 or 95 feet, but from the data, to which I have had access, I am disposed to think that 90 feet is nearly the true height. The change of level of the lake, that is, the difference between the extreme high water and the extreme low water marks, amounts to eight feet.

CLIMATE AND METEOROLOGY.

A general account of the Climate and Meteorology of Vermont is given in Part I. page 9 to 23, to which the following tables and observations are now added:

Monthly and Annual Mean Temperatures at Burlington,—continued from the table on page 9, *Part I.*

MONTHS.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	Mean, 11 Yrs.
	°	°	°	°	°	°	°	°	°	°	°	°
January,	22.30	28.02	9.91	21.36	19.77	20.97	24.17	15.06	23.74	19.60	14.36	19.93
February,	26.60	12.95	20.33	22.63	15.05	18.59	21.09	14.34	24.32	26.02	23.19	20.46
March,	35.80	25.66	31.00	34.09	33.89	25.73	29.03	31.66	30.47	33.35	28.50	30.83
April,	44.60	43.85	49.50	43.82	47.73	37.48	42.89	39.90	41.35	43.31	39.86	42.12
May,	53.50	53.92	58.50	53.81	57.60	56.40	58.86	51.59	51.64	54.13	56.16	55.10
June,	63.80	61 86	66.50	65.21	64.97	64.15	65.02	66.76	67.12	62.97	64.34	64.80
July,	70.00	64.16	67.10	68.40	69.51	71.03	68.39	72.74	70.03	67.40	71.08	69.08
August,	70.10	67.78	65.60	69.43	70.45	67.62	66.82	69.14	66.03	65.68	66.44	67.73
September,	57.30	59.59	59.90	58.12	64.75	58.80	56.41	58.02	59.69	60.58	59.42	59.32
October,	47.50	42.84	47.00	51.15	45.37	45.89	47.24	47.10	48.25	51.09	47.95	47.40
November,	34.40	31.56	34.10	39.26	41.26	39.84	34.81	43.29	40.38	31.74	35.58	36.39
December,	21.30	26.87	23.40	17.81	23.43	27.00	30.01	23.17	18.65	18.58	30.32	23.69
Annual Temp.	45.60	43.25	44.40	45.42	46.15	43.88	45.39	44.40	45.14	44.54	44.77	44.74

The above results were deduced from three daily observations, made at sunrise, 1 P. M. and 9 in the evening, by the Author. The location is in latitude 44° 29′ N. and longitude 73° 11′ W., and is one mile eastward from the shore of Lake Champlain, and elevated 256 feet above the lake, or 346 above the ocean.

EXTREMES OF TEMPERATURE.

Greatest and Least Heat in the Shade, and the Hottest and Coldest Day in each year since 1837—15 *years.*

Year.	Greatest Heat.		Greatest Cold.		Hottest Day.	Mean.	Cold. D. mean.	
		°		°		°		°
1838	June 10 and July 20,	93	January 31.	–13	July 29,	83	Jan. 30,	–6
1839	July 20,	91	January 24,	–19½	August 20,	78	Jan. 23,	–4⅓
1840	July 16,	94	January 18,	–16	July 16,	81⅔	Jan. 16,	–7
1841	August 18,	96	January 4,	–10	August 18,	82	Jan. 4,	⅔
1842	July 19, Aug. 26,	93	January 13,	–11	July 19, Aug. 26,	79⅓	Jan. 13,	–4⅔
1843	June 22,	90	Feb 'ry 17,	–17	June 22,	76	Feb. 17,	0
1844	June 19,	88	January 28,	–24	June 19,	74⅔	Jan. 29,	13⅔
1845	July 12,	96	Decemb. 11,	–18	July 21,	80	Dec. 11,	–11⅓
1846	August 5,	96	Feb. 10 & 19,	–10	August 5,	81⅔	Jan. 18,	–5
1847	July 19,	98	Feb 'ry 16,	–14	July 19,	83	Jan. 31,	⅓
1848	July 12,21,22: Au. 12,	92	January 11,	–25	June 18,	80	Jan. 10,	–10⅔
1849	July 12, 13,	100	Feb 'ry 17,	–17	July 13,	87	Feb. 18,	–7
1850	June 19,	93	February 6,	–18	June 19,	81¾	Feb. 5,	–4¾
1851	September 10,	92	Feb 8, Dec. 26	–17	September 10,	79¾	Feb. 8,	–11½
1852	June 16,	97	January 15,	–17	June 15,	81½	Jan. 20,	–5½

By the above statement it will be seen, that, during the last fifteen years, the range of the Thermometer has been from 100° above to 25° below zero, equal to 125°; and that the warmest day was the 13th of July, 1849, and the coldest day, the 29th of January, 1844, and that the difference between the mean temperature of those two days was 100⅔°.

ANNUAL MEAN TEMPERATURE AND WEATHER AT NEWBURY.

	THERMOMETER.				WEATHER.				
Year.	Mean heat.	greatest.	least.	Range.	Fair.	Cloudy.	Rain.	Snow.	Sn. & Rain.
	°	°	°	°	°	°	°	°	°
1840	44.28	90	-33	123	169	196	96	32	6
1841	44.36	86	-22	108	146	219	78	46	4
1842	43.61	86	-19	108	163	202	101	49	7
1843	43.70	90	-25	115	157	208	77	57	5
1844	43.83	86	-26	112	160	206	106	31	2
1845	43.44	88	-28	116	142	223	100	47	5
1846	45.44	90	-20	110	149	216	87	42	4
1847	44.44	90	-22	112	144	221	106	42	6
1848	44.83	87	-32	119	165	201	107	56	6
1849	44.13	94	-21	115	161	204	99	61	2
10 yr.	44.20	94	-33	127	156	209	96	51	5

The materials for the above table are derived from Meteorological observations made at Newbury, by Mr. Johnson, of that place, and published in the Annual Report of the Regents of the University of New York for 1850. These observations were continued through a period of twenty-seven years, but the earlier observations were made without a thermometer, and embraced only the clearness of the sky, the rains and snows, the course of the winds, the progress of vegetation, aurora borealis, and other rare phenomena. The mean temperature in the above table, is derived from three daily observations, made at 6 A. M., noon, and 6 P. M. This mean is probably a little higher than it would have been if the observations had been made at sunrise, 1 P. M. and 9 P. M., as in the preceding table. By a comparison of the eight years, from 1842 to 1850, which are embraced in both tables, the mean annual temperature of Burlington appears to be about two-thirds of a degree warmer than Newbury, while the latitude of the place of observation in Burlington is 23′ greater, and its altitude above the ocean about 75 feet less than the place of observation at Newbury.

MONTHLY AND ANNUAL FALL OF WATER AT BURLINGTON.

Continued from page 12, *Part I.*

MONTHS.	1842.	1843.	1844.	1845.	1846.	1847.	1848.	1849.	1850.	1851.	1852.	Mean, 11 Yrs.
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
January,	1.04	0.71	2.29	2.38	1.72	2.80	1.84	0.79	1.57	1.20	1.03	1.58
February,	3.75	1.43	0.73	2.52	1.47	1.85	0.90	0.41	1.79	1.90	1.69	1.52
March,	1.97	2.12	2.35	2.48	2.20	2.10	2.44	2.14	1.11	0.67	1.92	1.96
April,	2.52	0.82	1.43	2.22	0.91	3.15	1.09	0.47	2.41	1.67	1.15	1.62
May,	1.55	2.47	4.40	3.39	3.18	1.85	4.24	2.74	5.04	2.29	0.71	2.90
June,	3.24	4.58	2.08	2.08	3.63	5.05	2.19	1.41	3.18	7.33	4.76	3.59
July,	4.62	2.59	5.35	4.51	5.08	4.05	3.57	1.73	5.08	3.81	4.99	4.12
August,	1.74	2.09	3.46	2.37	0.48	3.12	4.40	5.69	0.89	1.92	1.50	2.51
September,	3.80	1.80	1.36	5.62	3.77	4.69	2.91	1.33	3.25	2.06	1.80	2.95
October,	4.10	5.03	5.11	2.26	2.65	3.69	2.59	5.32	8.11	3.56	4.11	4.23
November,	2.32	1.63	0.57	4.00	2.88	2.13	2.26	2.69	1.77	3.59	2.90	2.43
December,	3.20	1.48	2.08	2.21	1.68	4.07	2.95	1.63	3.31	1.83	2.26	2.41
	33.85	26.75	31.21	36.04	29.66	38.55	31.38	26.35	37.51	31.83	28.82	31.82

By the above table it appears that the greatest amount of water in any one year was 38.55 inches in 1847, and the least 26.35 in., in 1849,—range 12.20 in. The greatest monthly amount was 8.11 inches, in October, 1850, and the least 0.41 in. in February, 1849—range 7.70 inches. The proportion of the water, which falls in snow, is about one-fifth of the whole amount. The greatest rain-storms in the eleven years embraced in the above table, were on the 10th of July, 1844, when there fell 4.07 inches in twenty-four hours, and on the 22d and 23d of June, 1851, when the amount was 5.16 inches in thirty-six hours.

FALL OF SNOW, AND DAYS OF SLEIGHING IN TEN SUCCESSIVE YEARS.

Continued from page 12, *Part I.*

MONTHS.	1842–43	1843–44	1844–45	1845–46	1846–47	1847–48	1848–49	1849–50	1850–51	1851–52
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
October,	0	10	0	0	7	0	0	0	5	0
November,	9	3	2	0	5	4	3	1	1	24
December,	47	18	13	36	22	13	18	19	48	14
January,	7	16	20	9	24	11	10	16	11	24
February,	20	13	22	24	25	19	10	18	8	17
March,	38	18	12	4	22	20	7	12	14	22
April,	2	0	6	0	7	1	0	8	0	12
Total.	123	78	75	73	112	68	48	74	87	113
Sleighing,			35 d.	102d.	40 d.	16 d.	30 d.	80 d.	61 d.	87 d.

ADVANCE OF SPRING FOR ELEVEN SUCCESSIVE YEARS.

Continued from page 13, *Part I.*

Years.	Robins seen.	Bluebirds seen.	Barn Swallows seen.	Currants Blossom.	Red Plums Blossom.	Plums and Cherries Blossom.	Crab Apples Blossom.	Common Apples Blossom.
1842.	March 13	March 13	May 2	May 11	May 14		May 27	May 29
1843.	April 12	April 12	" 3		" 15	May 17		" 26
1844.	March 21	March 25	April 25	April 25	Apr. 30	" 4	" 9	" 11
1845.	" 9	" 13	May 3			" 13		" 21
1846.	" 25	" 26	April 29	" 29	May 5	" 10	" 13	" 17
1847.	" 25	" 25	May 4	May 16	" 20	" 22	" 26	" 28
1748.	" 25	" 28	" 4	" 5	" 11	" 14	" 18	" 20
1849.	" 14	" 26	" 10	" 20	" 23	" 26	June 1	June 4
1850.	" 29	" 28	" 2	" 13	" 19	" 20	" 2	" 4
1851.	" 20	" 22	April 25	" 9	" 14	" 15	May 21	May 24
1852.	" 16	" 17	" 30	" 16	" 18	" 20	" 23	" 27

Of our migratory birds, the Bob-o-link, *Icterus agripennis*, is undoubtedly one of the most regular in its return in the spring. In my account of that Bird, Part I, p. 70, it is said to make its appearance in the latter part of May. But from observations since made, and from information derived from others, I am satisfied that its arrival in Vermont very seldom varies more than two or three days from the 12th of May.

Closing and Opening of Lake Champlain and Running of the Line Steamers.—Continued from page 14, *Part I.*

YEAR.	Lake Closed.	Lake Opened.	Line boats commen'd running.	Line Boats stop'd.
1842	not clos.		April 13.	Nov. 29.
1843	Feb. 16.	Apr. 22.	April 27.	Nov. 30.
1844	Jan. 25.	Apr. 11.	April 19.	Nov. 29.
1845	Feb. 3.	Mar.26.	April 9.	Nov. 29.
1846	Feb. 10.	Mar.26.	April 13.	
1847	Feb. 15.	Apr. 23.	May 3*.	Dec. 2
1848	Feb. 13.	Feb. 26.	April 8.	Dec. 2.
1849	Feb. 7.	Mar. 23.	April 10.	Dec. 8.
1850	not clos.		April 15.	Dec. 9.
1851	Feb. 1.	Mar. 12.	April 7.	Nov. 28.
1852	Jan. 18.	Apr. 19.	May 3.	Dec. 13

The closing and opening of Lake Champlain have reference to the broadest part of the lake opposite to Burlington. With the exception of 1835, this part of the lake has never become frozen entirely over earlier than the 15th of January, within the last thirty-six years. The mean time of closing for that period would fall on the 1st day of February. During four of the years it did not close at all. The narrower parts of the lake usually become frozen over so as to interrupt navigation, through its entire length, early in December, and most of the bays become covered with ice about the same time.

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* Although the Line Boats commenced running so late as the 3d of May, they were for several days after that unable to proceed farther north than Plattsburgh, on account of the ice. It was not till the 6th that they were able to pass through the whole length of the lake, and then only by cutting through the ice for a distance of nearly six miles. The boats were not able to reach St. Albans till the 10th, and ice remained in many of the bays up to that time.

The following record, kindly furnished me by my friend Robert White, Esq., of Shelburne, exhibits the number of days, during which teams were able to pass upon the ice from Shelburne Harbor across the mouth of Shelburne Bay and the southeastern part of Burlington Bay, to Burlington, in each year since 1835.

Year.	Days passable.	Year.	Days passable.
In 1836,	76	In 1845,	12
1837,	81	1846,	36
1838,	47	1847,	67
1839,	61	1848,	16*
1840,	21	1849,	40
1841,	48	1850,	not passa.
1842,	24	1851,	46
1843,	56	1852,	82
1844,	67		

Lake Champlain Phenomena.

In Part I, page 14, something was said respecting the sudden disappearance of the ice from Lake Champlain in the spring of some years, and an attempt was made to account for the phenomenon, without having recourse to the absurd notion that the ice sinks. The explanations there given were founded, partly on observed facts, and partly on theoretic views. Additional observations have since been made, which, while they go to confirm the general theoretic principles, require some modifications of the results. It was there supposed that, when the general surface of the lake commenced freezing, the great body of the water below might be at a temperature 7° or 8° above the freezing point, and this, in accordance with the researches of Count Rumford, would doubtless be true were the waters gradually cooled down without agitation. But it is not found to be true in fact; and from recent observations it appears probable that, in consequence of their violent agitation by the cold winds which prevail in the early part of winter, the whole mass of water is cooled down very nearly to the freezing point before any ice is formed at the surface over the deeper parts of the lake, and that, after the waters are protected from the winds by a covering of ice, their temperature is gradually, but slowly, elevated by the reception of heat from the earth beneath. The following experiments show that the temperature of the water under the ice is, generally, some degrees above the freezing point, but not so much above as we had supposed.

On the 27th of March, 1844, when the lake had been covered with ice about eight weeks, at the distance of one-fourth of a mile from the shore, the temperature of the water was found to be, at the surface 32°, at the depth of 6 feet 32½°—at 12 feet 34½ and at 25 feet 35½°. On the 8th of March, 1852, when the lake had been frozen over 7 weeks, one-fourth of a mile from the shore, where the water was 28 feet deep, the temperature at the bottom was 34½°, that at the surface being 32°. On the 5th of April following, at the distance of one mile from the shore, the water being 82 feet deep, the temperature at the bottom was 34°. At the distance of 2½ miles from the shore, at an open crack where the water was 125 feet deep, the temperature at the bottom was 34½°.

The sudden disappearance of the ice from Lake Champlain has been a subject of remark and speculation, from the first settlement of the country. But to a person, who carefully observes the circumstances, there will not appear any thing in the phenomenon either mysterious or very wonderful. In order to its occurrence, the temperature of the great body of water must be some degrees above the freezing point, the ice must be reduced to the *honey-comb* structure, or brought into a condition in which it will easily separate into minute divisions, and there must be a wind sufficiently strong to produce considerable agitation of the water.

In addition to theoretic objections to the popular notion that the ice sinks, when it disappears suddenly, persons of observation, who live near the lake, have occular proof that it does not sink. The ice, while yet spreading over the entire surface of the lake, is seen to be gradually wasting as spring advances and to become less firm, till, at length, it is so far disintegrated that a stick may be thrust through it, while it is yet from 6 to 12 inches thick. This disintegration is sometimes carried so far, before the general icy covering is broken up, that the ice has little more solidity or tenacity than snow saturated with water. In this state of things, a strong wind soon produces rents in the ice,—the waters, before pent up and quiet, are thrown into violent agitation, and the slightly cohering masses are actually seen falling to pieces and dissolving on the surface of the water. But it is never seen sinking, nor was any ever seen lying at the bottom after it had sunk.

Some have supposed that the sudden absorption of so large an amount of caloric, as would be required for the liquefaction of the ice, would produce severe frost in the neighborhood of the lake, which is not found to be true in fact. But this difficulty is removed by the consideration, that the heat employed in melting the ice, is derived rather from the water than from the atmosphere, and that the surface of the lake, in contact with the atmosphere, after the ice is all melted, is still warmer than the icy covering was before.

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* The mouth of Shelburne Bay only.

There is another phenomenon connected with the freezing of Lake Champlain, which is of some interest. At Rouse's Point, where the lake passes into Canada, and where it narrows down into the form of a river and some current is perceptible, it becomes strongly frozen over long before the broad lake closes; but very soon after the broader and deeper parts of the lake become covered with ice, the ice begins to fail at this place and in a measure disappears, even while the cold is severe and ice is forming in other places. To many, this phenomenon has appeared somewhat mysterious; but its explanation may, probably, be found in the circumstance that the lake at Rouse's Point is quite narrow and shallow and that the water which passes there, before the broad lake freezes, is the surface water and consequently the coldest water of the lake. This cold water, passing the Point in a shallow, scarcely perceptible stream, is soon cooled down and congealed at the surface, and the ice usually becomes strong here before the main body of the lake is frozen over. But soon after the broad lake closes over, the ice begins to waste at the Point and usually fails here soon after it becomes good elsewhere. This failure of the ice here, is owing to the circumstance that, after the lake is covered with ice, the water passing off here is no longer the cold surface water, but the warmer water lying below. It is this warmer water by its motion, though moderate, under the ice and in contact with it, which causes the ice to fail here, while it is increasing in other places.

In February, 1851, there was an occurrence in Windmill Bay, on the west side of Alburgh, which is worthy of note; the lake and bay being at that time covered with ice. On Saturday, Feb. 15, the wind blew quite hard from the south, and the snow thawed so that water ran in the roads. Saturday evening the wind came suddenly round to the west and blew for a short time with great violence. In the morning of the 16th something unusual was observed in the bay, and on going to it, it was found that the ice had been ruptured for the space of five or six rods each way, and that there were two immense blocks of ice lying upon the firm ice at some distance from the opening made by the rupture. The largest of these blocks was 39½ feet long, with an average width of about 26 feet. The other was thirty-eight feet long and 20 wide, and their thickness was 17 inches. The nearest of these blocks was 7½ rods from the opening and they were both the same side up as when they were lying upon the water. The depth of the water at the opening was 17 feet, and the sides of the blocks matched, in part, the margin of the opening.

Respecting the cause and manner of this occurrence, there were various conjectures; many supposing that it must have been effected by the exertion of some sudden force or explosion from beneath. But as a fall from the least elevation must have inevitably broken such masses of ice into innumerable fragments, it is evident that it was not thrown out by a force acting upward, but by a lateral force, which caused the masses to slide upon the surface of the undisturbed ice, and to be thus removed from their bed without being broken. The cause of this lateral pressure was probably the wind. While the wind was blowing from the south, a crack might have been opened and these large fragments loosened. When the wind came round and blew violently from the west, this crack might have closed suddenly and the broken pieces, not returning exactly to their former position, might have been thrown out with a force sufficient to cause them to slide to the position in which they were found, without being broken.

QUADRUPEDS OF VERMONT.

Additional to Part I, Chapter II.

To our previous list of Mammalia, we now add two living species, and two extinct fossil species. They are the following:

Ves. noveboracensis,	N. Y. Bat.
Mus leucopus,	White bellied Mouse.
Eleph. primogenius?	Fossil Elephant.
Beluga vermontana,	Fossil Whale.

Besides these, we have made additions to our account, of the following:

Felis concolor,	Panther.
Phoca vetulina,	Seal.
Sciurus hudsonius,	Red Squirrel.

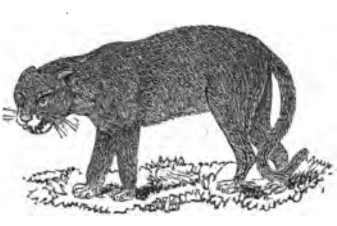
NEW YORK BAT.

Vespertilio noveboracensis.—LINN.

DESCRIPTION.—Head small; nose pointed. Ears broad, rather small; targus club-shaped. Interfemoral membrane broader than long, including the entire tail. This membrane is hairy above, but two-thirds naked beneath. Hind feet with five subequal toes, of which the outer are shortest. Brachial membrane naked above, excepting near the body and at the base of the phalanges: beneath, the hair extends farther from the body, and the patch at the base of the phalanges much more extensive. General color of the fur above, tawny red—beneath, the same, but much lighter. A whitish patch on the sides of the body at the base of the wings, most conspicuous on the under side. The brachial membrane is dark brown, beautifully reticulated with lighter color. Length of the specimen before me 4¼ inches, spread of the wings 12 inches.

History.—This Bat is less common in Vermont than several other species, and Vermont is probably near the limit of its northern range. According to Dr. DeKay, this is the most common species in the state of New York. Its range is from Massachusetts to the Rocky Mountains, and south through Pennsylvania. This Bat, from its red or ferruginous color, is very commonly called the *Red Bat*, and is figured under that name in Wilson's Ornithology. With the exception of the Hoary Bat, this is the largest bat found in Vermont, and in its measurements it scarcely falls short of the Hoary Bat, but its form is more slender.

For the specimen from which the preceding description is made, I am indebted to my friend C. S. Paine, of Randolph.



PANTHER, or CATAMOUNT, (Part I.-37.)

Felis concolor.—Linnæus.

Description.— Color of the face, head and all the upper parts of the body dark gray, slightly brushed with red. Interior of the ears, under side of the body and tail, and inner side of the legs grayish ash; between the hind legs and beneath the tail tawny white. Exterior of the ears, bottoms of the feet and extremity of the tail black. Also a black patch on each side of the nose, from which the whiskers proceed, and the two connected together by a brownish band over the nose. Chin, lower lip and part of the upper lip clear white. Nose naked, of a brownish copper color, and narrowly margined with white hairs. Whiskers 2½ inches long, white, intermingled with a few black hairs. Eyes oblique, with a whitish spot above and a little in front of each, and a smaller one below. Irides orange. Claws completely retractile, one inch long, very strong and sharp. of a pearly white color, having a blood red tinge on the under side near the base.

Dental Formula—Inscisors $\frac{6}{6}$ canines $\frac{1}{1}\,\frac{1}{1}$, molars $\frac{4}{3}\,\frac{4}{3} = 30$. Teeth all clear white, perfectly sound, exhibiting no marks of wear. Incisors small, outer ones largest. Canines conical and strong, projecting 1.1 inch beyond the gum. The carniverous molars project ¾ths of an inch. Posterior molars in the upper jaw not fully developed. The weight of the specimen before me, which is a male, is 86 pounds.

Length, from the nose to the root of the tail, 48 inches. Length of the tail (vertebræ 29.5, skin and hair beyond 1.5) 31. Total length 79 in., or 6 ft. 7 in. Length of facial line, from nose to occiput, 10. Width of the head between the ears, posteriorly, 4.5, anteriorly 6, between the eyes 2.5. Height of the rounded ear 3.5. Length of the humerus 8, fore-arm 9, thigh 11, leg 12. Circumference of the wrist 7.5, fore paw 7.5, ankle 6, hind foot 7. Height at the shoulders 26, at the rump 27. Girt of the neck 16 inches, just behind the fore legs 27 inches.

History.— The Panther here described, was caught on the western slope of the Green Mountains, in the town of Manchester, Bennington county, on the 5th day of February, 1850. It was taken, by a Mr. Burritt, in a trap set for a bear. Being caught by one of its paws only, and being quite ferocious, it was not deemed prudent to attempt to secure him alive, and he was killed by shooting him through the body. It was purchased by the Hon. L. Sargeant and a few others in Manchester, who, with a public spirit and zeal for the advancement of science truly commendable and worthy of imitation, presented it to the Museum of the University of Vermont, where its skin and skeleton are now preserved. In taking off the skin, the head, neck and inner sides of the fore legs were found very much filled with Hedge-Hog quills, which, in many cases, had passed entirely through the skin and were deeply embedded in the flesh. The trap, in which it was caught, had not been visited for some time previous, and, from appearances, it was supposed to have been several days in the trap, when found; and when shot it bled very profusely. Its weight was very much diminished by both these circumstances, and it was the general opinion, that, when first caught, its weight was not less than 100 pounds.

The teeth of this Panther were all perfectly sound and white, showing no marks of wear, and as the posterior molars in the upper jaw were not fully developed, there can be no doubt that it was a young animal, probably about two years old.

The Panther, above described, is the last and the only one which has been, to my knowledge, killed in Vermont for many years; and as the animal is now exceedingly scarce, and there may never be another obtained, within the state, for any of our museums, I have thought it advisable to be thus minute in its description and history, notwithstanding the full general account given in Part I—p. 37.

SEAL.

Phoca vitulina.—Linnæus.

In Part I, page 38, of my History of Vermont, will be found some account of a Seal captured on the ice on Lake Champlain in 1810. Another Seal was killed upon the ice between Burlington and Port Kent, on the 23d of February, 1846. Mr. Tabor, of Keeseville, and Messrs. Morse and Field, of Peru, were crossing over in sleighs, when they discovered it crawling upon the ice, and, attacking it with the but end of their whips, they succeeded in killing it, and brought it on shore at Burlington, where it was purchased by Morton Cole, Esq., and presented to the University of Vermont, where its skin and skeleton are now preserved. Before it was skinned I noted down the following particulars:

Total length of the Seal 50 inches; thickness just behind the fore legs 12 inches; weight 70 pounds. Length of the fore paw 7, nails 1¼, width 4; hind paw, length 8, nail 1, width 11, measured along the margin of the web, with the foot spread. Tail 3.5 inches long and 2 broad at the base; hair on the tail reversed, forming a crown at the extremity. Nose truncated and somewhat notched, being 2.5 inches across the extremity. Whiskers numerous, and nearly white; four erect, stiff and nearly white bristles, situated above and a little behind each eye. Distance between the eyes 2¼ inches.

The specimen was a female, having two abdominal mammæ situated thus $\left(.\,\dot{}\,\cdot\,{}^{\text{navel}}_{\text{teats.}} \right)$ The teats appeared rather like cavities than protuberances, and she was doubtless a female which had never suckled young.

Dental Formula—Incisors $\frac{6}{4}$ canines $\frac{1-1}{1-1}$, molars $\frac{5-5}{5-5}=34$.

Lower incisors quite small. Upper incisors larger, (the two outward ones largest,) overlapping the lower ones, when the mouth is shut. Canines rather large and hooking inward. The molars are placed obliquely in the jaw; that nearest the canines smallest, and increasing backward in size and in the number of their sharp pointed tubercles. Its dentition resembles very closely that of the common cat.

Its hair was short, stiff, thick and even. Color of the hair brown olive and tawny white, forming a beautiful dark spotted marbling, lighter and more tawny on the belly. Base of all the hairs on the hind feet brown olive, with the tips slightly brushed with white, giving them a hoary appearance. Hair on the fore feet obscurely mottled.

At the time the above mentioned seal was taken, the lake, with the exception of a few cracks, was entirely covered with ice.

WHITE BELLIED JUMPING MOUSE.

Mus leucopus.—Richardson.

Description—.Head moderately large, with the nose pointed. Eyes medium size. Ears large, rounded above, and naked, with the exception of a short down, which is whitish, along the margin. Auditory opening rather large. Whiskers turned backward, in part, longer than the head, some of the hairs black and some white. Fore feet with four claws and a rudimentary thumb, without nail. Hind feet with five toes, having feeble curved claws, nearly concealed by long white hairs. Tail slender, and slightly tapering. Incisors yellow. Fur fine, and rather long. *Color* above reddish brown, darkest along the back. The reddish brown extends downward on the shoulders and on the outside of the thighs, forming a band. All the under parts, from the chin to the extremity of the tail, including the feet and nails, pure white, excepting a narrow band of reddish brown under the base of the tail. Color of the fur, plumbeous, at its base. Length of the specimen before me, which is a male, measuring from the snout to the extremity of the tail, 7 inches; head 1, body 2.7, tail 3.3, fore feet, 0.45, hind feet, 0.8, whiskers 1.5.

History.—This Mouse is a very delicate and beautiful little animal. It is exceedingly active, often leaping to considerable distances in the manner of the Deer-Mouse, but it has nothing of that Kangaroo form, or disproportion between the fore and hind legs, which exists in that species. It is most common in forests and wooded places, but frequents, also, meadows and cultivated fields, particularly where grain and grass-seed abound. It also enters barns and houses in quest of food and shelter. Two or three have been taken in a trap, in my own cellar, during the past year, and they are frequently brought in by cats, in the village of Burlington. It is found on both sides of the Green Mountains. I lately received two specimens from my friend, C. S. Paine, which were taken in Randolph. It is found in all the northern states, and as far north as Hudson's Bay.

WHITE SQUIRREL.

Sciurus hudsonius, (Albino).—P. I., p. 46.

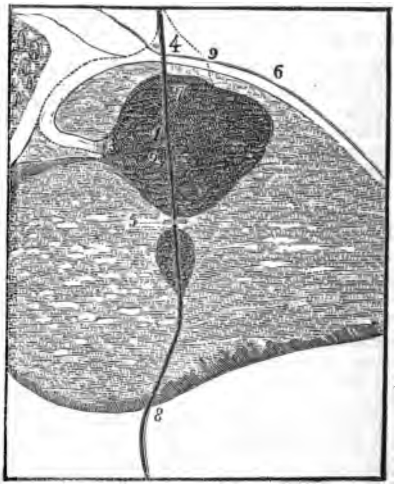
November 11, 1850, I obtained an individual of the species commonly called the *Red Squirrel*, or *Chickaree*, which was entirely white. It was shot, in the top of a large tree, near the railroad bridge, between Burlington and Colchester. There were two of these white squirrels in company, but only one of them was captured. This one was a male, and, although its form was slender and delicate, it had every appearance of having been healthy and active. Its entire length, from the nose to the extremity of the hairs of the tail, 12.5 inches—to the extremity of the vertebræ of the tail, 11, to the root of the tail, 6; length of the head 2. Color of the hair entirely of snowy whiteness. Nails white, with a slight carnation tinge. Eyes nearly transparent, with a slightly smoky aspect, but in the dead animal, they exhibited scarcely any of that redness, which is regarded as the characteristic of *albinos*.

FOSSIL ELEPHANT.

Elephas primogenius?—Blumenbach.

It is a remarkable fact that, in making the Rutland and Burlington Rail Road, which extends from Burlington to Bellows Falls, two of the most interesting fossils ever found in New England, were brought to light. These were the remains of an Elephant and a Whale: the former were found in Mount Holly, in 1848, and the latter in Charlotte, in 1849.

The Rutland and Burlington Railroad crosses the ridge of the Green Mountains, in the township of Mount Holly, at an elevation of 1415 feet above the level of the ocean, and the bones of the fossil Elephant were found at that height. In order that their true position may be understood, and a knowledge of it preserved, the accompanying rude map has been prepared. The map embraces an area of about 35 acres, lying at the summit level of the Green Mountains, over which the railroad passes.



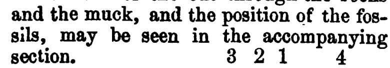
4. Station House. 6, Road.
Dotted lines, outlets of muck bed. 7. Division of water.

More than half of this area consists of a solid mass of rock, elevated considerably above the ground on each side, and only slightly covered with soil, or earth, excepting the cavities indicated, which are filled with vegetable muck. The line on the map, marked 5, denotes the ridge, which, previous to making the railroad, divided the waters flowing into Connecticut river from those falling into Lake Champlain. The cut, for the railroad, through this mass of rock, (from 4 to 8 on the map,) is about 180 rods in length, and from 12 to 35 feet deep. The muck beds are formed in basins excacavated out of the rock. The larger basin appears to have been originally filled with water, and to have been a favorite resort for beaver, a large proportion of the materials which formed the lower part of the muck, consisting of billets of wood, about 18 inches long, which had been cut off at both ends, drawn into the water and divested of the bark, by the beavers, for food. When first taken out, the marks of teeth upon the wood were as distinct as if they were the work of yesterday. At 3, the outlet of the basin, the beavers had constructed a regular dam for the purpose of deepening the waters within. But at the time the excavation for the railroad was made, the basin had become entirely filled with vegetable matter, which was in parts 15 feet deep, and its surface was a swamp, on which plants, shrubs, and small trees were growing. The billets of wood, which the beavers had brought in, were, many of them, three inches in diameter, and were of several kinds, as ash, willow, and alder.

These, together with numerous cones of black spruce and white pine, in a good state of preservation, were embedded in a thick vegetable mucilage, nearly resembling clay in color, but which, when cut in cakes and taken in the hand, would shake and tremble like a mass of jelly. A cake of this mucilage, when dried, was much lighter than cork, and was diminished to about one-eighth of its original bulk. The mucilage was undoubtedly produced by the solution of leaves and wood, which had steeped for ages in that basin of cold water, from which there was not a sufficient flow to carry it off. The billets of wood, when taken out from the bottom of the muck, appeared plump and fresh, as if they had been recently pealed, but were very soft, and in drying, they lost full five-sixths of their bulk.

In making the excavation for the railroad, through the muck-bed above described, in the latter part of the summer of 1848, the workmen found, at the bottom of the bed, resting upon gravel, which separated it from the rock below, a huge tooth, the place of which is indicated on the map and Cut by 1. The depth of the muck at that place was 11 feet. Soon afterwards, one of the tusks was found, at 2, about 80 feet from the place of the tooth, above mentioned, which was a grinder. Subsequently the other tusk, and several of the bones of the animal were found near the same place. These bones and teeth were submitted to the inspection of Prof. Agassiz, of Cambridge University, who pronounced them to be the remains of an extinct species of Elephant. The Directors of the Rutland and Burlington Rail Road, to whom they belong, design to have them placed in the Museum of the University of Vermont, for preservation, and for the illustration of our fossil geology.

The form of the cut through the rocks and the muck, and the position of the fossils, may be seen in the accompanying section.



1. Grinder. 3. Original dividing ridge.
2. Tusks. 4. Present division of water.

The grinder is in an excellent state of preservation, and weighed 8 pounds, and the length of its grinding surface is about 8 inches. The tusks are somewhat decayed, and one of them badly broken. The chord, drawn in a straight line from the base to the point, of the most perfect tusk, measures 60 inches, and the longest perpendicular, let fall from that to the inner curve, of the tusk, measures 19 inches. The length of the tusk, measured along the curve on the outer surface, is 80 inches, and its greatest circumference, 12 inches. The circumference has diminished very much since the tusk was taken from the muck bed, on account of shrinkage in drying, and several longitudinal cracks have been formed in it, extending through its whole length, and it was found necessary to wind it with wire to prevent it from splitting to pieces.

These are believed to be the only fossil remains ever found in New England, which have been, with certainty, ascertained to belong to an Elephant. Remains of Elephants have been found in several of the southern and western states, and very recently some fine specimens have been dug up in Ohio.

I have prefixed to this account the specific name of the Mammoth, or fossil Elephant of Europe, but have little doubt that ours is a distinct species, and I am happy in knowing that one of our best comparative anatomists is now investigating this very subject.

FOSSIL WHALE.

Beluga vermontana.—Thompson.

As many rare fossils are rendered nearly valueless by the want of an accurate knowledge of their localities, and of the circumstances in which they were found, I have deemed the above mentioned fossil, which is undoubtedly the most interesting of the organic remains yet found in Vermont, of sufficient importance to justify a minute history of its discovery and position, and the introduction of a small map of the locality. The discovery of this fossil took place in August, 1849. While widening an excavation for the Rutland and Burlington Rail Way, in the township of Charlotte, the workmen struck upon a quantity of bones, which were embedded in the clay at the depth of about eight feet below the natural surface of the ground. Some of the Irishmen remarked that they were the bones of a dead horse buried there; but little notice, however, was taken of them, till the overseers observed something peculiar in the form of several of the bones, and were, thereby, induced to examine them more carefully. It was soon found that the bones discovered, belonged to the anterior portion of the skeleton of some unknown animal, the head of which had already been broken into fragments, by the workmen, and many of the fragments carried away with the earth, which had been removed. On carefully removing more of the clay, a number of vertebræ were found, extending in a line obliquely into the bank, and, apparently arranged in the order in which they existed in the living animal. These vertebræ were taken out, and, together with the sternum, fragments of the head, ribs, &c., were forwarded to Burlington, and, by the kindness of Messrs. Jackson & Boardman, engineers on the railroad, were placed in my hands.

By a careful examination of these bones, I found that they belonged to some animal, with whose skeleton I was not acquainted, and that there were wanting, in order to complete the skeleton, the greater part of the head, all of the teeth, a considerable number of vertebræ and ribs, and the bones of the limbs. I was at first in some doubt, whether the animal belonged to the whale family or to the saurian; but this doubt was soon removed, by a careful examination of the caudal vertebræ.. These were found to have their articulating surfaces convex, and rounded in such a manner as to allow of a very extensive vertical motion of the tail, but of a very limited lateral motion. This arrangement plainly indicated that the movements of the animal in the water, were effected by means of a horizontal caudal fin, and that it, therefore, belonged to the family of *Cetacea*, or Whales.

The manner in which these caudal vertebræ move upon each other may be seen in the cut, where Fig. 1 represents the 13th, 14th and 15th vertebræ of the tail,—*a*, as they appear viewed from above—*b*, as seen laterally*.

After having carefully removed from the bones, I had received, the adhesive clay, in order to prevent their crumbling by exposure to the air, and secure their preservation, I saturated them with a thin solution of animal glue, and then proceeded to Charlotte in order to recover, if possible, the bones, which were missing. By spending several days in the search, I succeeded in obtaining most of the anterior portion of the head, nine of the teeth, and thirteen additional vertebræ, together with the bones of one forearm, several chevron bones, and portions of ribs. From the portions of the head, which I obtained, and the fragments previously received, I was able to reconstruct so much of the upper and anterior portion of the head, as to exhibit distinctly its *spiracles*, or blow-holes, showing unequivocally that it belonged to the Whale family. My next object was to ascertain, if possible, whether it was a living, or an extinct, species of this family. Being without specimens for comparison, my only reliance for aid was Cuvier's great work on Fossil Bones. By a comparison of the Fossil Whale with the descriptions and figures in that work, it was found to resemble the living rather than the extinct types, and that the osteology of the head was very like that of the *Beluga leucas*, or small northern White Whale.*

Having collected together all the bones and fragments of the Fossil, within my reach, I proceeded with them to Cambridge, Mass., and submitted them to the inspection of Prof. Agassiz, who confirmed the opinion I had formed respecting them, and, for two days, very kindly lent me his aid, and his great skill and knowledge of the subject, in their collocation and arrangement. Having, all together, more than four-fifths of the bones of the skeleton, he was able, from the number, position and size of these, to determine the number, position and size of those, which were missing, and thus to determine the size and form of the whole animal.

The head of the skeleton, as already remarked, was broken into a great number of pieces, and only a portion of the fragments recovered; but enough to determine its entire length and general form. Fig. 2 represents the head, as reconstructed out of the fragments, viewed from above; and fig. 3, a side view, with the lower jaw dropped a little below its true place. The entire length of the head is 21.2 inches. The maxillary bone on the left side is mostly wanting, but on the right side, it is entire, so far as to embrace the alveolar margin, which is 6.85 inches in length, and perforated for 8 teeth. The corresponding alveolar margin of the lower jaw measures 5.5 inches, and is perforated for 7 teeth. Hence it appears that there were 16 teeth in the upper jaw and 14 in the lower, making 30 in the whole.

The teeth are all of one kind, being conical, with flat or rounded crowns, much worn, but, in their substance, very dense and firm. They are from one to two inches in length, with a diameter of half an inch. Fig. 4 represents their different forms and sizes. Only nine of the teeth were recovered, and none of those were in their places when found; but, that they were in their places, up to the time the bones were first discovered, is evident, from the fact, that, while every other cavity in the bones was filled with clay, the alveoli were all empty.

Of the vertebræ, 41 were secured, of which four were cervical, eleven dorsal, ten lumbar, and sixteen caudal. Three cervical vertebræ, the first, fifth and sixth, are evidently missing, which, with the four obtained, make *seven*, the usual number. These vertebræ are all free, not being soldered together, as in the common dolphin,

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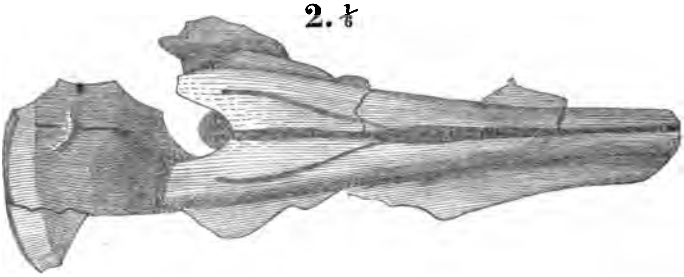
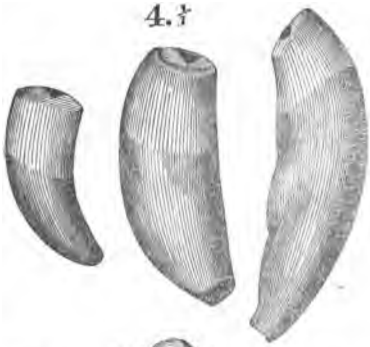
* The fractions after the number of the figure, when introduced in the accompanying cuts, denote the linear proportion of the cut to the object, which it represents.

* Cuvier's Osse. Foss., Vol. V, page 299 and Plate XXII, fig. 5 and 6,—Paris edition, 1825.

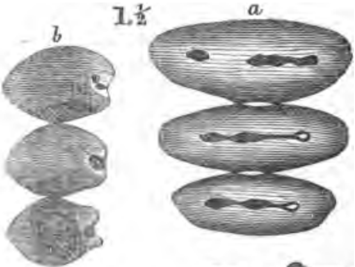
2. $\frac{1}{6}$



4. $\frac{1}{1}$

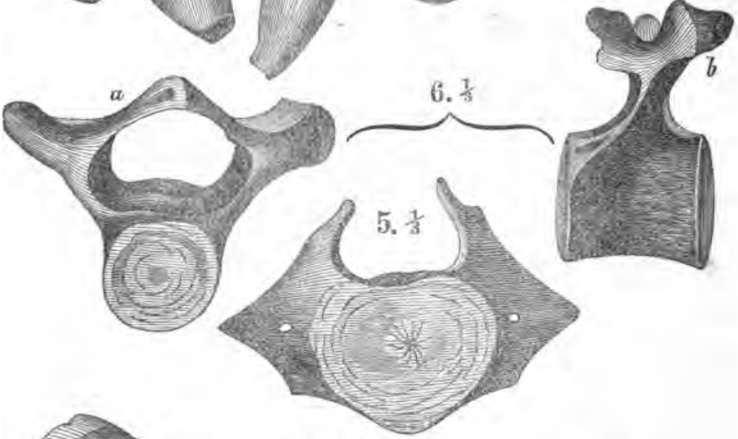


1. $\frac{1}{2}$

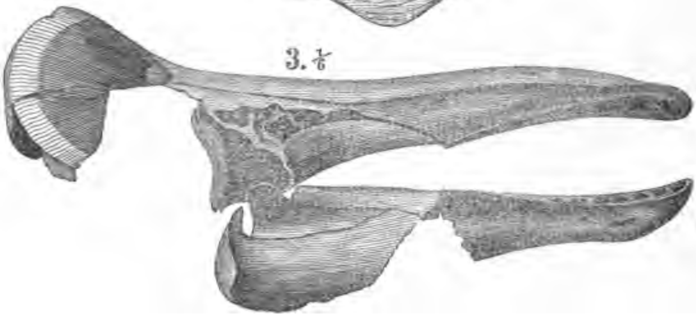


6. $\frac{1}{3}$

5. $\frac{1}{3}$



3. $\frac{1}{6}$



and some other cetacians. Fig. 5 represents the third cervical vertebra.

The second and twelfth dorsal vertebræ are missing, the whole number being thirteen. Fig. 6, represents the seventh dorsal vertebra—*a*, as seen from behind—*b*, as seen laterally.

The lumbar vertebræ amount to twelve, of which the sixth and twelfth are missing. Fig. 7, represents the seventh lumbar vertebra. These vertebræ all have the same general form, but the lateral winged processes are more decayed and broken in some of them, than in the one here represented.

The eleventh and seventeenth caudal vertebræ are missing, and perhaps a nineteenth and twentieth, making the, probable, whole number, twenty. Fig. 8, represents the fourth caudal vertebra. The form of those nearer the extremity of the tail may be seen in fig. 1.

From these statements, it will be seen, that the whole number of vertebræ in the skeleton was 52, eleven of which are missing. Two of the missing vertebræ were known to have been taken away, after the bones were discovered. Articulating surfaces, at the meeting of the caudal vertebræ, indicate five chevron bones, of which the fourth only is wanting. Fig. 9, represents the second chevron bone.

The total length of the vertebral column, due allowance being made for the eleven missing vertebræ, and 17 inches for the aggregate thickness of the 51 intervertebral cartilages, is one hundred and thirty-seven inches. Of this length, the cervical vertebræ make 10 inches, the dorsal 40, the lumbar 48, and the caudal 39. The lumbar vertebræ are largest, having an average length of about 4 inches, with a diameter of 3 inches. The total length of the animal, including the head and caudal fin, must have been about 168 inches, or 14 feet.

Fig. 10, is the *hyoid* bone, and Fig 11, the *sternum*, both of which are large and strong, in proportion to the size of the skeleton. The former measures 8.5 inches in a right line, from point to point, and the latter is 15 inches long, from 3½ to 7 wide, and on an average about one inch thick.

The ribs are considerably decayed and broken. The longest entire rib measures just 24 inches along the curve. Fig. 12, represents the anterior rib, on one side. It is very strong, consisting of two portions, of nearly equal length, of solid bone.

Fig. 13, represents the scapula, the humerus and the bones of the fore-arm of the left fin, in their connexion. The scapula and the ulna of the right side were recovered, but all the other bones of the paddles are wanting. The height of the scapula is 7 inches; the length of the humerus 5, and of the fore-arm 4 inches.

I was able to obtain the following measurements of the head, which admit of direct comparison with a part of the measurements, given by Cuvier, of the head of *Beluga leucas*:

	B. vermontana.	*B. leucas.*
Length of the head, from the occipital condyles to the end of the snout,	21.2 inch.	20.9 inch.
" of one side of the lower jaw,	16.5 "	16.5 "
" of alveolar margin, "	8.2 "	7.8 "
" of the symphysis, "	3.1 "	3.1 "

Between these measurements, it will be seen that there is a very close agreement; but they disagree in their dental formulæ, as expressed below:

	B. vermontana.	*B. leucas.*
Dental Formulæ,	$\frac{8}{7}\ \frac{8}{7} = 30$:	$\frac{9}{9}\ \frac{9}{9} = 36$.

They also differ in the relative width of the maxillary and intermaxillary bones, as developed on the upper side of the snout, and also in the outlines of the head.

Since the above measurements and comparisons were made, I have had an opportunity to examine the bones of three heads of *B. leucas*, in the Hunterian Museum, in London, and an entire skeleton of the animal in the collection of Prof. Agassiz, at Cambridge, Mass. On account of the absence of Prof. Agassiz, when I visited Cambridge, a minute comparison of my fossil bones, with the corresponding bones of his skeleton, was not gone into, but a sufficient number of bones was compared, to leave little doubt that they belong to different species of the same genus. I have, therefore, described my Beluga under the specific name of *vermontana*, which I gave it, provisionally, in my first account of the fossil*.

LOCALITY.—In order to prevent any doubt, hereafter, in regard to the precise place in which these fossil bones were found, I have here introduced a little map of the township of Charlotte, on which I have marked the locality by a black ■. The township is six miles square, and bounded on the west by Lake Champlain. The single lines denote the principal roads passing through the township. The railroad passes through it, from north to south, nearly parallel to the lake shore, and at an average distance of 1½ mile from it. The distance between the two roads, which cross the railroad, one on the north and the other on the south side of the locality, is about 80 rods; the distance to the locality, from the north road, being perhaps 25 rods, and from the south road, 55 rods. The northern road crosses the railway on a bridge, over the excavation, elevated about 16 feet above

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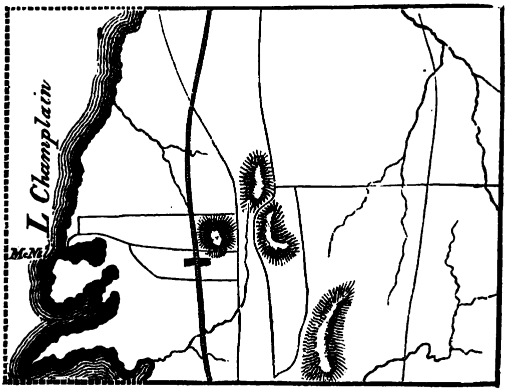
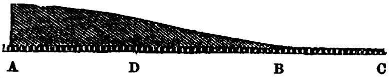
* Silliman's Journal of Science, Vol. IX, p. 256.

MAP OF CHARLOTTE.



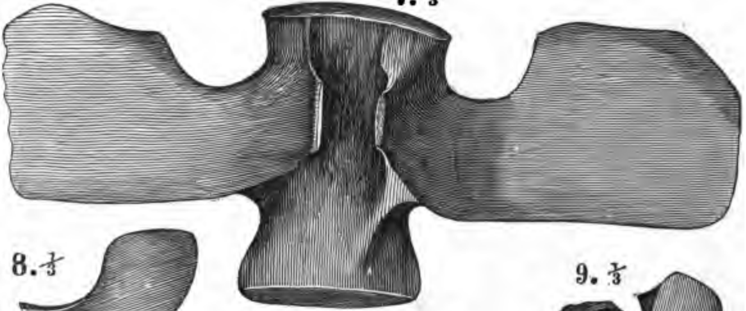
the track: the southern road crosses on a level with the track. The accompanying cut exhibits a section along the east side of the excavation, in which the bones were found. The surface of the ground slopes to the south, and, to the depth of four feet, consists principally of sand, showing no signs of stratification. Next, below this, is a mixture of sand and clay, finely and regularly stratified, for a depth of 2½ feet, below which is a vast bed of fine blue clay, in which were observed no signs of stratification, and which appears to have been, previous to the deposit of the stratified sand and clay above it, an extensive quagmire.

SECTION.

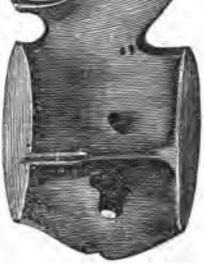


A and C denote the points where the two roads, above mentioned, cross the railroad; A the northern road, and C the southern, and the line A C the distance between the roads. From C to B, the railroad track is on the level of the natural surface of the earth; and from B to A at the bottom of the excavation in the clay bed. D indicates the point in the line of the road, where the fossil bones were found.

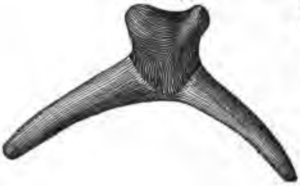
7. $\frac{1}{3}$



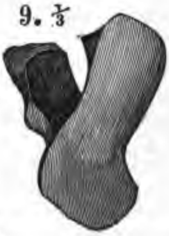
8. $\frac{1}{3}$



10. $\frac{1}{6}$

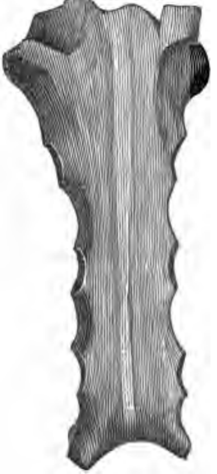


9. $\frac{1}{3}$

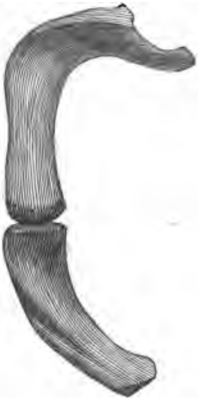


The fossil bones were embedded in this clay, at an average depth below its surface of nearly two feet. The head of the skeleton was towards the northwest, was lowest, and was nearly on a level with the railway, while the posterior parts extended obliquely into the bank, towards the southeast. In the blue clay, with the bones, were found some vegetable remains, and also specimens of *Nucula* and *Saxicava*. At the surface of the blue clay were great numbers of *Mytilus edulis* and *Sanguinolaria fusca*, and the latter were scattered through the stratified sand and clay above. The locality, as ascertained by the railroad survey, is 60 feet above the mean level of Lake Champlain, and 150 above the ocean.*

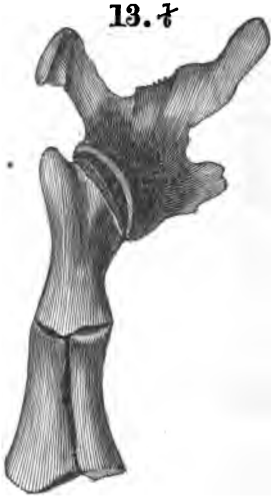
11. ⅙



12. ⅙



13. ⅙



BIRDS OF VERMONT.

Additional to Part I, Chapter III.

To our list of Birds given in Part I, page 53, we now add the following species:

Tyrannus cooperi,	Olive sided King Bird.
Muscicapa traillii,	Traill's Flycatcher.
" *ruticilla*,	American Redstart.
" *pusilla*,	Green Blackcap Warbler.
Vireo gilvus,	Warbling Vireo.
Merula olivacea,	Olivebacked Thrush.
Sylvia striata,	Black-poll Warbler.
" *ruficapilla*,	Red-poll Warbler.
" *pardolina*,	Canada Warbler.
" *parus*,	Hemlock Warbler.
" *philadelphia*,	Mourning Warbler.
" *americana*,	Particolored Warbler.
Fringilla borealis,	Mealy Redpoll.
Coccoborus ludovicianus,	Rosebrested Grosbeak.
Tanagra rubra,	Scarlet Tanager.
Picus pileatus,	Crested Woodpecker.
Ardea minor,	American Bittern.
Tatanus melanoleucas,	Greater Yellow Shanks.
Tringa semipalmata,	Semipalmated Sandpiper.
Colymbus septentrionalis,	Red Throated Loon.

We also make additions to our former account, of the following:

Falco chrysaetas,	Golden Eagle.
Cypselus pelasgius,	Chimney Swallow.
Columba migratoria,	Passenger Pigeon.

THE GOLDEN EAGLE.

Falco chrysaetas.—LINN.

In May, 1845, two eagles of this species were observed flying near the summit of a high hill, in Pittsfield, in this State. One of these was shot and wounded. It flew about half a mile and pitched down into a thick forest, but could not then be found. About a week afterwards, it was discovered and captured. It was confined in a stable, fed on meat, and kept there more than a year. It was then sent to Middlebury, to Prof. C. B. Adams, who, on the 23d of Oct., 1846, sent it to me, at Burlington. I kept it in an open cage, or coop, in the corner of my yard, through the winter, and watched its conduct with much care. It was a female, and was, in her disposition, very savage; and during the 7 or 8 months I kept her alive, I made very little progress towards taming her. She would strike with her feet with the quickness of a cat; and, after having had a piece of meat snatched from my hand so suddenly that I scarcely had a glimpse of the claws that took it, I thought it most prudent to keep my hands beyond her reach. She was most fond of meat when first killed, but, if hungry, she would not reject it after it had become putrid. When a hen, or dove, was killed and thrown into her cage, she would suddenly pounce upon it, striking in her claws with great force. She would then stretch up her neck and look around, as if exulting over the victory she had achieved. Before eating a particle of the fowl, she would take it to her roost, and holding it with one foot, she would pick it, with her beak, as cleanly as if it were to be cooked.

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* In 1847, a portion of the skeleton of a whale, was found in the same kind of clay, as that in which the bones were found in Charlotte, in the vicinity of Montreal. It was found about 15 feet below the surface, in digging clay for making bricks, and was about 100 feet above the level of the St. Lawrence. The portion found, consisted of 19 consecutive vertebræ, which measured, all together, when arranged in their order, 4 1-2 feet. About one-third of the vertebræ were caudal, the other two-thirds sacral and lumbar. These fossil bones were carried to London, by Mr. Logan, Provincial Geologist, where I had an opportunity of comparing with them some of the vertebræ of *B. vermontana*, at the Museum of the Geological Survey of Great Britain, and I have little doubt that they are identical in species.

The length of this specimen was 33 inches, the spread of her wings 72, the folded wing 24, tarsus 3.5, tibia, 6.5, tail, consisting of 12 feathers, 10.5. It weighed, when killed, on the 19th of May, 1847, 10.5 pounds, the greater part of the weight being made up of the muscles of the wings and legs.

Note.—The specimen, belonging to the Museum of the University of Vermont, which I have described in Part I, page 60, without a name, I have satisfied myself to be an old female Bald Eagle.

THE OLIVE-SIDED KING-BIRD.

Tyrannus cooperi.—Nuttall.

Description.—General color above, dark olive, becoming dusky brown on the head, wings and tail. Chin, throat, belly, and under tail coverts, white, tinged with light greenish yellow. Secondaries edged with white, and the wing coverts tipped with gray, giving the appearance of two obscure bars on the wings. Breast and sides of the belly, brownish, with an irregular yellowish white band from the throat down the breast to the belly. Legs and feet black. Upper mandible, blackish horn color; lower, yellowish, darker at the point. Irides hazel. Bill stout and broad. Second quill longest, first and third equal. Tail emarginate, extends one inch beyond the folded wings. Length, 6.5 inches; spread, 12.5.

History.—This species was first distinguished from the Wood Pewee, which it much resembles, by William Cooper, in 1829, and was described and named, in honor of its discoverer, by Mr. Nuttall. Its range is from Texas to the 53d parallel of latitude, and from New England to Oregon. It is a rare bird in New England, but numbers of them spend the summer and rear their young here. For the specimen, from which the above description was made, I was indebted to my friend C. S. Paine, who shot it in Randolph, in this state. The nest of this King Bird is usually built in the top of an evergreen, from 30 to 50 feet from the ground, and resembles, somewhat, that of the common King Bird. The eggs, four in number, are of a yellowish cream-color, thinly sprinkled with dark brown and purple spots. A nest, found by Mr. Paine, was on a horizontal branch of a tall hemlock, standing alone in a pasture, near the border of woods. The nest, containing three eggs, was composed of twigs, moss, and a few blades of grass. It was very flat, and slovenly put together. This bird manifests much uneasiness and anger, when its nest is approached, erecting its crest, and becoming very clamorous. These birds are known to breed, in the same locality, several years in succession.

TRAILL'S FLY-CATCHER.

Muscicapa traillii.—Aud.

Description.—Color of the head and body above, dark glossy olive green; circle round the eye and streak towards the bill, pale yellow. Wings, dark hair brown; secondaries and wing coverts edged with dull white, forming two bars across the wings. Bill, blackish above, flesh-colored beneath. Chin and throat yellowish white; breast, ashy brown; belly, and under tail coverts, pale sulphur yellow. Legs black. Tail emarginate. Length, 5.75; spread 8.75.

History.—This species bears a very strong resemblance to the *M. flaviventris.* It is quite a common bird at some places along the east side of the Green Mountains, in Vermont, particularly along the second branch of White River, in Bethel and Randolph, where, I am informed by my friend, Paine, it rears its young in large numbers. Its nest is usually built in a low bush, by the side of a stream, from one to four feet from the ground. The nest is composed, outwardly, of wild grass and wool, and lined with very fine grass and weeds. It is very snugly put together, and nearly two inches deep. The eggs, usually three, are of a yellowish white color, sparsely sprinkled with light umber toward the larger end.

THE AMERICAN REDSTART.

Muscicapa ruticilla.—Linnæus.

Description.—Upper parts, bill, chin and breast, black; sides of the breast, base of the primaries and of the tail feathers, excepting the two middle ones, fine reddish orange, sometimes approaching scarlet. Belly white. *Female* and *young* olive brown above, head cinereous; beneath, yellowish white. Sides of the breast, base of the quills and tail feathers, yellow, where they are orange in the male. Bill and legs smoky olive. Notch in the bill small. Second and third primaries subequal and longest. Length, 5 inches; spread, 6.5.

History.—This beautiful little bird is found in all parts of the United States, and extends its summer migrations as far north as the 62d parallel of latitude. It arrives in Vermont about the middle of May. It is a shy and retiring bird, confining itself to the forests and groves. It builds its nest, usually, between the forked branches of a small tree, or sapling, 10 or 12 feet from the ground. The nest is very securely and neatly built, being made of fibres and shreds of bark, very firmly agglutinated together. The eggs, 3 or 4 in number, are of a light cream color, thickly sprinkled with different shades of yellowish brown, particularly towards the large end.

THE GREEN BLACK-CAP WARBLER.

Muscicapa pusilla.—Wilson.

Description.—Crown, glossy black; back, rump, and upper tail coverts, olive green. Frontlet, line over the eye, and all beneath, bright lemon yellow. Tail and wings, hair brown, the feathers having their outer vanes edged with yellow olive. Bill, brown; legs, flesh color. No part white. Second and third quills longest, subequal. Tail long and rounded, reaching more than one inch beyond the tips of the folded wings. *Female* and *young* without the black crown. Length, 4.5 inches; spread, 6.5.

History.—This species appears to be very widely diffused, being found in Labrador, in latitude 58° north, where it breeds, and as far westward as Columbia river. According to DeKay, it arrives in New York early in May, but is in that state exceedingly rare. Their nests are built on low bushes, in which they lay about four grayish eggs, which are sprinkled with reddish dots, in a circle around the larger end.

THE WARBLING VIREO.

Vireo gilvus.—Bonaparte.

Description.—Pale greenish olive. Head and upper part of the neck, dark ash, approaching to brown. Line over and beneath the eye, and extending from the eye to the nostril, light ash. Wings and tail, hair brown, the feathers edged with greenish gray. Upper mandible dark horn color, the lower one lighter. Chin and under parts dull greenish white. Sides of the body and beneath the wings, dull greenish yellow. Legs, bluish brown. Length, 5 inches; spread, 8.

History.—This Vireo, though plain and unadorned in plumage, is one of the most musical of the feathered warblers. Its range is through the whole extent of the United States, from the Atlantic to the Pacific. The nest of the Warbling Vireo is usually pendulous, and placed in the very summits of the loftiest trees. Nuttall has found them elevated to the airy height of more than 100 feet from the ground. The nest is made of the fibres of weeds and shreds of bark, and lined with grass. The eggs are from 4 to 6, white, with confluent spots and thread-like lines towards the larger end. My friend, C. S. Paine, who kindly favored me with a specimen of this bird, and its nest, which was built in the top of a lofty elm, near his dwelling, in Randolph, assures me that the favorite resort of the Warbling Vireo is among the trees and bushes, growing by the side of ponds and streams.

THE OLIVE-BACKED THRUSH.

Merula olivacea.—Giraud.

Description.—General color above, yellowish olive brown; breast and throat buff, spotted with black; belly, soiled white, spotted with reddish brown. Bill, brown, short and robust. Legs, flesh color, line from the bill to the eye slightly rufous. Outer webs of the primaries, yellowish. Lower tail coverts, white. Second primary longest, first and third nearly equal.—Length, 6.5 inches; spread, 11. Length of the tarsus 1 inch. Tail extends 1 inch beyond the folded wings.

History.—This species was long regarded as a variety of the Hermit Thrush, *M. solitaria*. It was first shown to be a distinct species by Mr. DeRhane, and was first described and named by Mr. Giraud, in his Birds of Long Island. This bird rears its young in Vermont, and is not very rare. Its nest, which is built on the ground in the woods, is composed of leaves and vines, and lined with fine roots. It has 4 light blue eggs, but somewhat darker than those of the Hermit Thrush, or very nearly the color of those of the Robin. It probably rears two broods in a season, since my friend Paine assures me, that he has found their nests, containing eggs, in the months of June, July and August.

THE BLACK-POLL WARBLER.

Sylvia striata.—Wilson.

Description.—Head deep glossy black; back mottled with black, white and dark ash. Cheeks, collar round the neck, and under parts generally, white, largely spotted with black on the breast and sides; line of black spots from the chin towards the shoulders. Two white bars on the wings. Primaries brown, edged on their outer webs with greenish yellow. Tail, wood brown, the two outer feathers on each side having large white spots on their inner webs. Bill, dark horn color. Tail emarginate, reaching three-fourths of an inch beyond the folded wings. Legs, flesh color. *Female* and *young* dull yellowish olive, streaked with black and gray. Length 5 inches; spread, 8.

History.—The Blackpoll Warbler is pretty generally diffused over the United States, and has been observed as far north as the 54th parallel of latitude. Audubon found the nest of this species in Labrador, built in the forked branches of a fir tree, about three feet from the ground. It was formed of mosses and lichens, lined first with coarse dried grass, then with fine moss, and lastly with feathers. The nest contained 4 eggs, but he has given no description of them. It probably breeds in Vermont, but I am not aware that its nest has ever been found here.

THE RED-POLL WARBLER.

Sylvia ruficapilla.—Latham.

Description.—General aspect brownish olive, streaked with dusky brown; crown dark rufous. Line over the eye, and all beneath, yellow. The two lateral tail feathers with large spots of white on their inner webs, extending to their tips. The yellow on the breast streaked and spotted with bay. Legs and bill dusky brown. The first three quills nearly equal, second longest. Tail slightly notched, and reaches one inch beyond the folded wings. *Female* without the rufous crown, and having the spots on the breast brown instead of bay. In the young male the crown is spotted with bay, and the breast yellowish brown. Length, 4.75; spread, 7.5.

History.—The history of this little warbler appears to be very little known. I have two specimens, a male and a female, from which the above description is drawn. They were both shot by my friend Paine, in Orange county, in 1848, one on the 20th of April and the other in September. It has been observed, according to DeKay, from Mexico to the 55th degree of north latitude. Whether it breeds or not in Vermont, I have not been able to ascertain.

THE CANADA WARBLER.

Sylvia pardalina.—Bonaparte.

Description.—All the upper parts bluish ash, with central parts of the feathers on the head, black, giving it a dark spotted appearance. Wings and tail brown, edged with grayish. Line under the eye descending down the side of the throat towards the shoulders, black. Spot in the forehead, a broad line towards the eye, and all beneath, bright lemon yellow. A broad rounded band of black spots across the breast, forming a sort of collar. Under tail coverts white, tinged with yellow. Upper mandible brownish; the lower mandible, the legs and feet, flesh color. Second and third primaries subequal, longest. Tail long, rounded, reaching 1.2 beyond the tips of the folded wings. The female is greenish above, and all its markings less distinct. Length, 5 inches; spread, 8.5.

History—This is a rare species, being only occasionally met with in Vermont. It breeds, according to Audubon, in Pennsylvania, Maine, and the British Provinces, and if so, it doubtless breeds in Vermont, though I am not aware that its nest has been found here. It is said to range as far north as the 55th degree of latitude. The nest is usually built in a low evergreen. The eggs, about five in number, are white, with a few dots of brownish red.

THE HEMLOCK WARBLER.

Sylvia parus.—Wilson.

Description.— Color above greenish yellow, striped with dusky; bill, wings and tail brownish black; two white bars on the wings; quills edged with greenish. Line over the eye, throat and neck yellow; beneath, yellow, streaked with dusky on the breast and sides; under tail coverts white; patches of white on the inner webs of the two outer tail feathers; legs and under mandible greenish yellow. First quill longest; tail emarginate. Length, 5.25; spread, 8.5

History.—This bird resides, for the most part, in thick Hemlock forests, and hence it has derived its name. Its nest, according to Audubon, is usually built in a hemlock or spruce, at a considerable elevation from the ground, and is composed of slender twigs and lichens, and lined with hair and feathers. The specimen above described was shot in Randolph, and the bird, no doubt, breeds here.

THE MOURNING WARBLER.

Sylvia philadelphia.—Wilson.

Description.—Head and sides of the neck bluish slate; upper parts of the body, wings and tail, dark yellowish olive-green; space before the eye, and frontlet, black.

Chin, throat and sides of the neck bluish gray. Breast black, with numerous fine crescent-shaped blue-gray lines. Beneath bright lustrous yellow. Bill smoky horn color; legs flesh color. In the female and the young, the throat and breast are buff, the latter much the darkest, and all the upper parts are a greenish olive. Length, 5 inches; spread, 7.5.

History.—The Mourning Warbler derives its name from its peculiar melancholy notes. The specimen, from which the above description is chiefly drawn, was shot by my friend, C. S. Paine, in Randolph, on the 4th of July. It was a male, had with it a mate and a brood of young ones, just able to fly. This warbler is a rare bird, and is of shy and solitary habits. Its range, so far as at present ascertained, is between the 23d and 47th parallels of latitude.

THE PARTI-COLORED WARBLER.

Sylvia americana.—Latham.

Description,—Color pale blue above, with a large golden umber spot on the back. Upper mandible black; lower, yellowish. Chin, throat and lower part of the breast, bright yellow. A blackish collar, bordered below with umber, mixed with yellow. Sides, under the edges of the folded wings, spotted with bay. Belly bluish white. Two white bars on the wings; and outer tail feathers largely spotted with white, on their inner webs. Wings and tail brown, the quills and feathers edged with light blue, on their outer webs. Legs and feet fuliginous. Three first quills nearly equal. *Female* without the dark collar on the breast. Length, 4.5, spread, 6.4 inches.

History.—This very beautiful little warbler ranges from Mexico to the 46th parallel of latitude, and is very common in the western states. It arrives in New England about the beginning of May. Its nest, according to Audubon, is built in the upright forks of small trees, and is composed principally of lichens, lined with downy substances. The eggs, about 4, are white, with a few reddish dots near the larger end.

THE MEALY REDPOLL.

Fringilla borealis.—Savi.

Description.—Above dusky, streaked with yellowish white and rusty. Wings and tail, hair-brown, the feathers edged and tipped with yellowish white. Rump whitish. Crown dark rich crimson. Frontlet, lores and throat black. Beneath, grayish white, streaked with dusky. Legs, feet and nails black. Cheeks, sides of the body and posterior part of the rump, in the male, pale carmine. First primary longest, second and third nearly equal. Bill yellow, brownish towards the point; very acute, upper mandible longest. Hind nail long as the toe. Length, 5.5 inches; spread, 9.

History.—This species, though very rare, is quite widely diffused, being found in Maine, New Jersey and Oregon. The specimen from which the above description was made, was shot in Randolph, in the winter of 1850. They appeared there in flocks, and fed upon the seeds of weeds, which projected through the snow, in the open fields. They were not seen in the forests. Its notes were very much like those of the common yellow bird, *F. tristis.* In appearance it very closely resembles the Lesser Redpoll, *F. linaria;*—so closely that there is some difficulty in distinguishing them. It is, however, somewhat larger, and its colors a little lighter, particularly on the rump.

THE ROSE-BREASTED GROSBEAK.

Coccoborus ludovicianus.—Linnæus.

Description.—Head, chin and upper parts mostly black, varied with white on the wings and rump. Tail and wings brownish, with a broad white bar across the quills of the latter, and a narrower one on the wing coverts. Breast and under wing coverts carmine, or bright rose color. Beneath, yellowish white. Bill, cream color; legs and feet grayish brown. *Female* brown above, spotted with dull white on the wings; three yellowish white bands on the head, one passing from the bill over the crown to the occiput, and one passing along each side of the head, just over the eye. Feathers on the breast yellowish, with a brown central streak; under wing coverts sulphur yellow; no rose color. Bill brown horn-color. Tail slightly emarginate. Bill notched near the point. Second quill longest. Length, 8 inches; spread, 13.

History.—The range of this bird is said to be from Texas to the 56th parallel of latitude. Though not numerous in Vermont, they are frequently met with and rear their young here. Its nest is usually built in thick forests, at a considerable height from the ground, and composed of twigs and lined with grass. The eggs are 4 or 5, bluish and spotted with brown.

THE SCARLET TANAGER.

Tanagra rubra.—Linnæus.

Description.—The bill robust, rather short, compressed towards the point, and acute. The second quill longest. Tail slightly forked. In the *male*, the plumage is of a brilliant scarlet, excepting the wings and tail, which are black, and the under wing coverts, which are yellow. Bill and legs brownish horn color. *Female* and *young* dull green, or brownish yellow. Wings and tail, brown, with the feathers edged with greenish. Color of the bill and legs lighter than in the male. Length, 6.6 inches; spread, 10.5.

HISTORY.—This bird, on account of the bright red color of the male, is sometimes called the *Fire Bird.* It is also known in many places as the *Blackwinged Red Bird.* It rears its young in Vermont, but is said to extend its summer migrations northward, as far as the 69th parallel of latitude. Its nest is usually built on the horizontal branch of a forest tree, 10 or 15 feet from the ground. It is composed of sticks, weeds and vines, nicely put together, and lined with finer materials. The eggs are usually 4, of a dull blue color, spotted with different shades of brown. It is a shy bird, occupying retired places, and manifests great solicitude for the safety of its young. One of the nests of this bird, found by my indefatigable friend, Paine, in Randolph, was on the branch of a maple, in the skirt of a forest, was 10 feet from the ground, and composed of hemlock twigs, laced and bound together with fibrous weeds and strings. It was 1.5 inch deep, and contained three eggs. The male bird showed much uneasiness when the discoverer approached the nest.

THE CRESTED WOODPECKER.

Picus pileatus.—LINNÆUS.

DESCRIPTION.—General color black. Chin white, with a rusty white stripe over the eye, and another from the nostril extending backward along the side of the neck to the base of the wings, which are, on the under side, of a delicate straw color. Vanes of the basal part of the wing feathers, white on the upper side, but nearly concealed by the wing coverts, when the wing is closed. Crest and mustachios, in the male, bright yellowish carmine red; crown variegated with black and golden yellow. Irides bright orange; bill and claws dark horn color, the bill a little lighter below, sharply ridged above and on the sides; with the mandibles, which are of equal length, brought to vertical cutting edges at their points. Tongue slender, protractile and barbed towards the point. Tail wedge-shaped; feathers 12, stiff and pointed, central ones longest. Length of the specimen here described, which was a female, 18 inches; spread, 28; from the point of the bill to the feathers 2.4; to the top of the crest 4.5. Length of the folded wing, 9.5,—tail, 7, reaching three inches beyond the tip of the folded wing.

HISTORY.—For the specimen here described I was indebted to Mr. Austin Isham, of Williston, who shot it near Shelburne pond, on the 10th of November, 1851. It was a female, and on skinning and dissecting it, I found in its craw more than 100 flat, jointed worms. They were, most of them, entire, about an inch long, and of a yellowish white color; such, in short, as are very common between the bark and wood of old trees. The gizzard contained parts of worms, and a large quantity of the fragments of ants and coleopterous insects, but no gravel.

Though no where numerous, this Woodpecker is found in all parts of the United States and as far north as the 63d parallel of latitude. In Vermont it has been very generally called the Woodcock. It is a very restless and retired bird, confining himself chiefly to the depths of the forests, and hence he is much more frequently heard than seen. In the early part of spring, as is well known to those employed at that season in the manufacture of maple sugar, his loud cackle and the sound of his powerful blows upon the old trees, are heard, reverberating through the naked forests, to a great distance. Like the other woodpeckers, it builds its nest in a cavity, hollowed out of an old tree, and lays about 6 purely white eggs.

CHIMNEY SWALLOW,—(Part I—98.)

Cypselus pelasgius.—TEM.

In our account of this bird, we spoke of its habit, when the country was new, of resorting in immense numbers to hollow trees, in spring and autumn, and that there were many trees in this state, which were, on that account, extensively known as *swallow trees.* Many of these trees had, probably, been resorted to by thousands of birds, year after year, for centuries. The consequence would naturally be, that the hollow, in which they roosted, would be gradually filled up from the bottom, by the excrement, cast off feathers, exuvia of insects, and rotten wood; and trees have been often found in this condition, long after the swallows had ceased to resort to them; and even after they had been blown down, and had become rotten by lying. One of this kind, in Ohio, is described in Harris' Journal, and quoted in Wilson's Ornithology. The tree was a sycamore, five feet in diameter, which had been blown down, and whose immense hollow was found filled, for the space of 15 feet, with a "mass of decayed feathers, with an admixture of brownish dust and the exuvia of various insects."

The remains of a tree of this description were found in this state, in Middlebury, so lately as the spring of 1852. The tree had been blown down, and had, nearly all, rotted away, leaving little besides the cylindrical mass, which had filled its hollow. The length of this mass was about seven feet, and its diameter 15 inches. Of the materials, which composed it, about one half consisted of the feathers of the Chimney Swallow, being, for the most part, wing and tail-feathers. The other half was made up of exuvia of insects, mostly fragments and eggs of the large wood-ant, and a brown substance, probably derived from the decayed wood of the interior of the tree.

This discovery at Middlebury, though interesting, would not have been regarded as very remarkable, if the materials, which had filled the hollow of the tree, had been promiscuously and disorderly mingled together. Such a jumbled mass would be what we should expect to find in a hollow tree which had been, for centuries, perhaps, the roosting place of myriads of Swallows. But this is not the case. In their general arrangement, the larger feathers have nearly all their quills pointing outward, while their plumes, or ends on which their webs are arranged, point inward. This arrangement might perhaps have arisen from the nesting of small quadrupeds in the hollow, making the feathers their bed. But this is not the most remarkable circumstance connected with the subject. In various parts of the mass, are found, in some cases, all the primary feathers of the wing; in others, all the feathers of the tail, lying together in contact, and in precisely the same order and position, in which they are found in the living swallow. In a lump of the materials, measuring not more than 7 inches by 5, and less than 3 inches thick, five wings and two tails were plainly seen, with their feathers arranged as above mentioned, and, in one of the wings, all the secondary quills were also arranged in their true position with regard to the primaries.

Now, we cannot conceive it possible that these feathers could be shed by living birds, and be thus deposited. We may suppose that the birds died there, and that their flesh had been removed by decay, or by insects, without deranging the feathers. But in that case, what has become of the skeletons? I do not learn that a bone, beak, or claw, has been found in any part of the whole mass. What, then, has become of these? They could hardly have been removed by violent means, without disturbing the feathers. But, if done quietly, what did it? What insect would devour the bones, and beaks, and claws, and not meddle with the quills? Or would the formic, or any other acid, which might be generated within the mass, dissolve the former without affecting the latter? These are questions, to which the *savans* have not yet returned any satisfactory response.

A specimen, from the above mentioned feathery mass, was obtained, in May, 1852, by Mr. J. A. Jameson, Tutor in the University of Vermont, and presented, by him, to the Museum of that Institution, to be preserved as a relic of primeval Vermont.

PASSENGER PIGEON.—(Part I, p. 100.)

Columba migratoria.—LINN.

Having learned that Pigeons had appeared and reared their young in large numbers, in the spring of 1849, in several towns on the Green Mountains, particularly in Fayston and Warren, in Washington county, and being desirous in case they should return there the next spring, to visit the localities, for the purpose of observing the habits of the Pigeons, and securing some of their eggs for specimens, I addressed a note of inquiry to Jacob Boyce, Esq., of Fayston. To this note I received the following reply:

FAYSTON, June 28, 1850.

MR. THOMPSON:

Sir,—I have received yours of the 10th inst., requesting information about Pigeons. They are not here the present season. Last year they came here early in April, and commenced building their nests by the middle of that month; and they left here with their young, about the middle of June. Their nests extended over a territory of, at least, 3,000 acres. Above the height of 25 feet from the ground, the tops of the trees were covered with nests. Some large birches had from 100 to 125 nests on a tree. The nests consisted of bunches of sticks, placed in the crotches of the limbs. They laid only two eggs in a nest, and raised only one brood. There might have been any quantity of eggs obtained from the nests; and great numbers of eggs rolled out of the nests and lay scattered on the ground, but I do not know that any of the eggs were preserved.

Respectfully yours,
JACOB BOYCE.

AMERICAN BITTERN.

Ardea minor.—WILSON.

DESCRIPTION.—General color yellowish ferruginous, mottled and sprinkled with dark brown. Crown dusky reddish brown. Chin and throat white, with reddish brown stripe. From the angle of the mouth a brownish black stripe proceeds downward, becoming broader on the side of the neck, and turning upwards towards the back side, where it is lost. The quills are also brownish black. Feathers of the neck and breast have their central part along the shaft dark yellow, sprinkled thickly with brown, broadly margined with tawny cream color. Dorsal plumage dark umber brown, with the feathers edged and spotted with yellowish brown and tawny white. Plumage about the vent and inside of the thighs, ochre-yellow. Legs, feet and nails greenish olive-brown. Bill dark greenish horn color, longer than the head, straight beneath, moderately arched above, stout, pointed, serrated on both mandibles, and, on the upper, notched towards the point. Tibia bare nearly an inch above the joint. Middle toe longest, pectinated. Hind nail longest. Feathers on the back of the head and neck loose and elongated. Tail small, rounded, and of 10 feathers. Length of the specimen before me, which is a female, 25 inches. Bill, along the gape, 4, along the ridge, 2.6 ; neck 11 ; folded wing 10 ; tail 3 ; tarsus 3 ; longest toe 3 ; longest nail 1.2.

History.—The specimen of American Bittern described above, was presented to me by my friend, N. A. Tucker, Esq. It was shot by him in his garden, in Burlington village, where it had alighted, on the 30th of April, 1845. It was a female, and contained several eggs, which were somewhat enlarged. About the first of June, Prof. J. Torrey found the nest of one of these birds in a swamp, in the east part of Burlington. It was made on the ground, of sticks and grass, was very shallow, and contained 6 eggs. The eggs were of a dark bluish brown clay color, and contained young, which were considerably advanced.

This bird is called by a great variety of names, but is most generally known in Vermont by the name of *Stake Driver*. This name is given it, on account of the resemblance of the sound, it makes in the breeding season, to that made by a smart blow and its echo, in driving a stake into the ground, resembling somewhat the uncouth syllables of *'pump-au-gah*. It is a sly, solitary bird, and feeds on mice, aquatic reptiles and the larger insects, and though not often seen, its sound is not unfrequently heard during the summer, proceeding from the depths of the swamps, in various parts of the state. Its range, according to DeKay, is between the 38th and 58th parallels of latitude.

THE GREATER YELLOW-SHANKS.

Totanus melanoleucas.—Gemlin.

Description.—Color of the upper parts brown, spotted with black and white. Bill, black; rump and tail dusky white, barred with brown. Throat, belly, and under tail coverts, white. Legs and feet yellow. A small black spot before the angle of the eye. Shaft of the first primary white. Length, 13 inches; folded wing, 7.25; bill, along the ridge, 2.1; under mandible shorter, and both cylindrical towards the point. Tarsus 2.5 inches long; middle toe to the nail 1.5. A short web between the inner and middle toes.

History.—This bird appears in Vermont in the latter part of May, proceeding northward, where it is found in the summer up to the 60th degree of latitude. Some of them, however, remain in Vermont through the summer, and breed here. It builds its nest, according to Nuttall, in a tuft of rank grass, on the border of a creek or bog, and lays 4 eggs of a dingy white color, marked with spots of dark brown. The eggs are said to be remarkably large for the size of the bird. Perhaps its most common vulgar name is that of *Tell-Tale*.

THE SEMI-PALMATED SANDPIPER.

Tringa semipalmata.—Wilson.

Description.—The bill is shorter than the head, straight, enlarged and flattened towards the end, and acutely pointed at the tip. Tibia one-fourth naked; tarsus compressed and of the length of the bill. Hind toe short and small. First quill longest. Tail pointed, reaching beyond the folded wings; middle feathers longest. The color of the bill is black; the legs dark dusky olive. General color above grayish ash, thickly streaked and spotted with dusky brown, while the feathers are edged with light gray and rufous. Frontlet and line over the eye, light gray. All beneath, white, excepting the breast and lower front of the neck, which are gray, with brownish spots and streaks. Length, 6 inches; folded wing, 3.7; bill and tarsus each 0.8; middle toe, which is longest, including the nail, 0 8.

History.—This little Sandpiper ranges through all parts of the United States. It appears in Vermont in May, and remains here till autumn, and undoubtedly breeds here, although I have not seen its nest. According to Nuttall, it makes its nest, early in June, of withered grass, and lays 4 or 5 eggs, which are white, spotted with brown. For the specimen above described I am indebted to Mr. C. S. Paine, of Randolph, who shot it in the fall of 1850.

RED-THROATED LOON.

Colymbus septentrionalis.

Description.—Color of the head and upper parts of the neck, deep ash. Chin and sides of the mouth, white. Sides of the throat and neck, white, spotted, or striped with ash. Upper parts brownish, spotted with white, the feathers usually having a white spot on each side toward the point. White beneath, with a brownish transverse band across the vent. Wings brownish black; second quill longest, first nearly equal. Tarsus much compressed, with a slight web along the edge, black on the outside and whitish on the inner side. Outward side of the feet, and a part of the web on the inner side, blackish. Bill bluish black, lightest towards the point, narrow and pointed; upper mandible longest and a little curved; lower, incurved on the sides, acute at the tip and grooved beneath. Tongue pointed, with a fringe at the base directed inward. Eye moderate; irides dark purple; pupils black. Length of the specimen above described, which is evidently a young fowl, 24 inches; bill, along the ridge, 1.7, beneath, 1.9, along the gap, 2.9; folded wing, 10.6; tarsus, 3.2; longest toe, (the outer,) 3.2, nail 0.3. Tail very short and rounded, reaching two inches beyond the folded wings. Adults have the head lead color, the upper parts blackish, the belly white, and a reddish stripe along the throat and neck.

History.—The Loon above described was shot in Burlington Bay, on the 1st day of November, 1846. It is very rare in Vermont, in comparison with the *C. glacialis*, or Great Northern Diver, described in Part I, p. 111. They are common in the northern parts of both continents, and rear their young in the neighborhood of fresh water lakes. They lay their eggs, 2 in number, on a small quantity of down, or other soft materials, near the edge of the water. They are of a pale oil-green color, and are nearly 3 inches long and 1¾ in thickness. This fowl is called, in England, the Sprat Loon, by the fishermen. It is known in some places by the name of Scape Grace.

Note.—In Part I, Chap. iii, we have described 141 species of Vermont Birds; and we have in this Appendix described 20 additional species, making the whole number described 161 species. And even this number falls very considerably short of the whole number of species found in the state. I have specimens of several species, which are not here described, on account of doubts with regard to their proper names. And it is well known that we have a considerable number of ducks and other water fowl, which spend some time with us, in spring and fall, in their annual migrations north and south. The Swan, *Cygnus americanus*, is occasionally met with, even in the small ponds in the interior of the state. My friend, Dr. Ariel Hunton, of Hydepark, informs me that a Swan was shot in Mud pond, in Cambridge, by Mr. Eliel Page, in 1841. It was very large, said to be six feet high, to spread its wings eight feet, and to weigh 57 pounds. These statements are doubtless exagerated, particularly the last. The length of the American Swan is usually stated at about 5 feet, and spread 7 feet.

REPTILES OF VERMONT.

Additional to Part I, Chapter iv.

Although we are well satisfied that we have a considerable number of species of reptiles, which are not embraced in our list in Part I, page 113, we shall here add only the two following:

Emys geographica,	Geographic Tortoise.
Trionyx ferox,	Soft-shelled Tortoise.

GEOGRAPHIC TORTOISE.

Emys geographica.—Le Sueur.

Description.—Shell oval, rather depressed, smooth, widely emarginate in front, serrated behind, and deeply notched over the tail. Vertebral plates slightly carinate, the first hexagonal, rounded in front—the three following somewhat larger, subequal, and hexagonal. The two intermediate lateral plates largest, and pentagonal—the posterior rhomboidal. Marginal plates 25, the three first on each side subequal, with a nearly equal margin,—the three following restricted, with their outward margins turned upwards; the seventh slightly turned upwards and widening posteriorly. The five remaining ones on each side are two toothed on their outer margins, the bidentations becoming more distinct to the last. *Sternum* deeply notched behind, and slightly before—scapular plates small, triangular—brachial plates truncate, triangular; third pair of plates narrow, with their exterior edges projecting laterally and backward, and joining the 4th and 5th marginal plates at their junction,—the fourth pair largest and joining the fifth marginal plate and a small intermediate one; five pairs of trapeziums, with the longest of the parallel sides outward; caudal plates rounded posteriorly, with the two straight sides forming an acute angle. *Head* moderately large; edges of the jaws very sharp. *Legs* rather long; upper sides of the fore legs covered with flat roundish scales, largest on the outer margin; fore feet armed with five sharp incurved claws; hind feet broad, palmate, covered with flat scales towards the posterior margin, and armed with five claws, longer but less curved than on the fore feet. *Tail* conical, pointed, and reaching 1¼ inch beyond the shell. *Color*, greenish brown, with meandering yellow lines, crossing one another in various directions. Under side of the marginal plates greenish yellow, with numerous and somewhat regular brown markings. *Sternum*, yellowish flesh-color. Head, neck and legs, beautifully striped with brownish and yellow. Jaws of a uniform yellowish umber,—a yellow spot on each side of the head, back of the eye. *Eyes* yellow, with a horizontal black stripe. Sutures, at the junction of the plates above, a little elevated. Length of the shell, 10 inches; breadth, 8.5; length of the head, 2.75; width, 1.8; between the orbits, 0.5; width of the palmated hind foot, 2.4; length of the tail, from the attachment of the vertebræ, 3.3; beyond the shell, 1.25.

History.—The specimen here described, was taken in Colchester, near the mouth of Winooski river, on the 28th of May, 1846. It was a female, containing 14 mature eggs in the oviduct, with about the same number, considerably developed, and innumerable small ones, in the ovaries. She was crawling very fast over the sandy plain, when taken, and was evidently in search of a suitable place for depositing her eggs. The form of the mature eggs, was that of an ellipsoid, with one end a trifle larger than the other, and they differed not sensibly in size, being 1.4 inch long, 0.9 thick, and having their greatest circumference 3.7 in., and least, 2.9. The oviduct, containing the mature eggs, was taken from the abdomen, cut into three pieces, and laid aside, and, in the course of ten minutes, by repeated visible contractions, or throes, all the eggs were expelled from it.

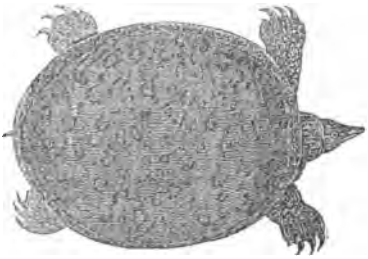
Another female of this species was taken, June 10th, 1846, near Clay Point, in Colchester. She was sitting over a hole she had excavated in the sand, in the act of depositing her eggs, and made no effort to escape when approached. Her oviduct was filled with mature eggs. I learn that in ploughing the sandy lands near this Point, nests of this tortoise, containing from 12 to 20 eggs, have been frequently laid open.

The chief habitat of this species is in the states at the south-west, and I was not aware of its existence in New England, at the time of the publication of my History of Vermont, in 1842. Since that time, I have found that it is quite common all along the eastern shore of Lake Champlain. It has not, however, to my knowledge, been found any where else in New England; and, for the present, this may be regarded as its eastern limit.

The dimensions of the shell of this species, given by Dr. DeKay, are: length, 6.5 in.; breadth, 5, and height 3. Most of those observed in this vicinity have been from 7 to 10 inches long, and from 6 to 8.5 broad. Their flesh is said to be a very palatable article of food.

Genus Trionyx.—*Geoffroy.*

Generic Characters.—Shell without plates, and, together with the sternum, cartilaginous, and extending over the edges into a flexible margin. Feet palmated, with three sharp claws. A corneous beak, covered with fleshy lips. Nose produced. Vent near the extremity of the tail.



SOFT-SHELLED TORTOISE.

Trionyx ferox.—Gmelin.

Description.—General color of the shell brownish olive, above, with ocellated spots, formed mostly by a circular arrangement of black dots, and with a border formed of black dots around the margin of the shell. The spots are usually about the size of a dime. In dried specimens, the color is nearly black, and the spots very obscure. All the under parts dull white, or light flesh-color. A bright yellow line, edged on both sides with black, extends from the snout to each eye, and from the eyes backwards, till lost in the marbling of the neck. Irides bright yellow, crossed by a black medial stripe. Upper side of the legs varied with black and yellow. Form orbicular; shell bony in the central part, with the margin cartilaginous, soft and flexible. Head long and pointed, snout projecting beyond the jaws, with large open nostrils at the extremity. Jaws horny, with the lips fleshy and revolute. Upper side of the legs, next the margin of the shell, covered with horny scales. Five toes on each foot, three of which have well developed claws, the others are enveloped in a web, forming paddles for swimming. Tail projects less than an inch beyond the shell, with the vent near the extremity.

Dimensions:—Length of the shell, 13 inches; breadth, 10¾; height, 3½; head, 2½; head and neck, 7.

HISTORY.—The existence of this species of Tortoise in our waters, was not even suspected by me at the time of the publication of my History of Vermont, in 1842. My first specimen of it, I obtained on the 10th of August, 1844. It was caught on a fish-hook, in the river Lamoille, in Milton, by Mr. Joseph Dupau, to whom I have been indebted for many interesting specimens of reptiles and fishes. Since that time I have obtained several other specimens, which were taken in or near the mouth of Winooski river, in Burlington. Most of these I kept alive for some weeks, but I could induce none of them to take any food; and, although it might be inferred, from the name, *ferox*, that they were of a ferocious disposition, I could never cause either of them to bite at a stick, notwithstanding I frequently provoked them for that purpose.

The specimen, which furnished the materials for the preceding description, was taken in a seine, at the mouth of Winooski river, on the 6th of May, 1848. I kept it alive till about the middle of June, when I killed and skinned it. It was a female, and her ovary contained 29 eggs, enlarged to near the size of a musket ball, besides innumerable minute eggs.

The *Trionyx ferox*, though common in the western waters, has not, to my knowledge, been found any where in New England, excepting the western parts of Vermont, along the margin of Lake Champlain; but it would seem, from the dimensions given by naturalists, that it attains a larger size here than at the west, where it is more common. The shells of three specimens, taken in this vicinity, measured as follows, viz:

	Length.	Breadth.	Height.
1.	11 inches;	9.5 inches.	2.2 inches.
2.	13 "	10.75 "	3.2 "
3.	13.5 "	11 "	3.5 "

The dimension of the shell of this species, given by Dr. DeKay, Zoology of New York, Part III, p. 6, are: length, 5.3 in.; breadth, 5 in.; height, 1.4.

This species resembles the sea-turtle, in its structure and habits, much more than our other tortoises. It leads a more aquatic life, and, probably seldom, if ever, crawls out upon the land, except for the purpose of depositing its eggs. On account of the shortness of its legs, and the great width of the shell, it travels upon land with much difficulty, especially where the surface is uneven, or covered with vegetation. Its flesh is esteemed a wholesome and nutritious article of food.

FISHES OF VERMONT.

Additional to Part I, Chapter V.

To our list of Vermont Fishes, given in Part I, page 128, we now add the following species:

Lucio-perca canadensis,	Ground Pike Perch.
Boleosoma tassellatum,	Darter.
Cottus gobioides,	Little Stargazer.
Leuciscus atromaculatus,	Small scaled Dace.
Esox nobilior,	Masquallonge.
Salmoperca pellucida,	Trout Perch.
Coregonus clupeiformis,	Herring Salmon.
Amia ocellicauda,	Bowfin.

THE GROUND PIKE-PERCH.

Lucio-perca canadensis.—SMITH.

L. grisea, DEKAY, Zoology of New York, Part IV., page 19.

DESCRIPTION.—General form elongated, cylindrical, and proportionally more slender along the abdomen than in the common Pike-Perch, but the head and opercules resemble that species very closely. The preoperculum is finely serrated on the posterior margin, and more coarsely below. There are also fine serratures on the lower margins of the preoperculum and suboperculum, near their junction. Instead of a single ridge proceeding from the upper anterior angle of the operculum, and terminating backward in a single spine, there are usually several ridges radiating thence, and often terminating in the opposite margin in very acute spines. Humeral bones armed posteriorly with several spines. Vent midway between the ventrals and the caudal fin. The anal fin commences under the fourth ray of the second dorsal. The first dorsal begins in a vertical line, passing through the base of the ventrals. Caudal forked.

General *color* grayish or brownish yellow, or orange, lightest beneath. First dorsal sprinkled with roundish black spots of the size of a small pea, usually arranged in two or three rows, nearly parallel to the line of the back, but without the black patch on the posterior part, which forms a conspicuous mark in the *L. americana*. Second dorsal, and the caudal, barred with black, or brown. Usual length, 13 inches.

Rays, B. 7, D. 13–1|18, P. 13, V. 1|5, A. 12, C. $17\frac{5}{5}$.

HISTORY.—When the Natural, Civil and Statistical History of Vermont was published, I was well satisfied that the species here described was distinct from the *L. americana*, but was not so clear whether it was a species already described, or not. The difference between this species and the *L. americana* is so obvious, that they are instantly distinguished, even when there is no difference in size; but while the latter species often exceeds two feet in length, and weighs five or six pounds, the *L. canadensis* seldom, if ever, exceeds 14 inches in length, or half a pound in weight. It is much less common in Lake Champlain than the *L. americana*, but is frequently taken in company with it. It usually swims very near the bottom of the water, and hence it has received the name of *Ground Pike*, (Pike-Perch). As an article of food, this species is held in the same high esteem, as the Common Pike-Perch.

Genus Boleosoma.—*DeKay*.

Generic Characters.—Two dorsal fins. Opercule scaly, with a single spine. Preopercule smooth on the margin. Six branchial rays. Nape depressed, contracted.

THE DARTER.

Boleosoma tassellatum.—DeKay.

Description.—A small fish, with a row of quadrated black spots, about seven in number, along the dorsal ridge, occupying about one-half of the space. A row of lozenge-shaped black spots, a little smaller than those on the back and about the same in number, along the lateral line, on each side of the body. General color of the remaining parts brownish yellow, approaching to white on the belly. Eyes moveable in their sockets; pupils black, surrounded by a golden line, which fades outward into a gray iris. Fins yellowish white, with faint brownish bars on the dorsals and caudal fin. Body cylindrical, covered with rough scales. Head rather small; eyes large and projecting; nape depressed.

History.—The habits of this fish are quite peculiar. It moves not from place to place by an even labored motion, like other fishes, but proceeds by sudden leaps, or darts, impelling itself forward by its tail and pectoral fins, which it moves as a bird does its wings. It remains suspended in the water no longer than it keeps its pectoral fins in rapid motion. When the motion of its fins ceases, the fish sinks, at once, to the bottom, showing that its specific gravity is greater than water, owing, doubtless, to its want of a swimming bladder. When it reaches the bottom, it alights upon its stiff ventral fins, upon which it stands on the bottom, balanced, with its head elevated, as a bird stands on its feet. I kept several specimens of this fish alive, in a vessel of water, for some time, for the purpose of watching their motions and learning their habits. They were very uneasy, and seemed extremely anxious to escape from their confinement. Aided by their caudal and pectoral fins, in giving them an impulse upwards, and by their ventrals in climbing and adhering, they would often raise themselves up the perpendicular side of the vessel, entirely above the surface of the water, excepting only the caudal fin. Another peculiarity of this fish, is its power of bending its neck and moving its head without moving the body, in which respect it equals many of the reptiles. This fish is entitled to the name of *Darter*, both from its sudden motion, and from its having the general form of a dart.

THE LITTLE STAR-GAZER.

Cottus gobioides.—Girard.

Description.—*Color*, blackish on the back, mottled with light yellow; abdomen white; lower parts of the sides and under parts posterior to the vent, yellow—all the under parts finely sprinkled with black specs. *Fins;* first dorsal blackish, edged with red; all the others barred with brown and yellow, except the ventrals, which are white, close together, and a little behind the pectorals. *Teeth* sharp and fine, like velvet pile, on both jaws. *Tongue* large and fleshy, with a patch of teeth. *Head* large, broad, and a little flattened, with the eyes, which are large, on the upper side and near together. A sharp, stout spine on the preoperculum. *Lips* rather fleshy, and the upper one a little protractile.—*Body* thick forward, tapering very fast towards the tail. Lateral line nearest the back, consisting of a furrow with the edges a little raised. Caudal fin rather large, and nearly even. Pectorals very large, and rounded. Ventrals long and narrow. Vent anterior to the middle. Skin thickly covered with mucus. No scales.

Total length, 4 inches; to the commencement of the first dorsal fin, 1.2; to the vent, 1.7. Width of the head, 0.95.

Fin Rays, B. 6, D. 7—17, P. 14, A. 12, C. 15.

History.—For the specimen here described, I was indebted to the kindness of Mr. R. Colberth. He caught it, while fishing for trout, in a branch of the river Lamoille, in Johnson. This fish usually lies still at the bottom, or concealed under the stones in the streams, and seldom moves, except when disturbed, and then its motions are sluggish and labored. It is called, in some places, the Slow Fish.

It probably derived the name of Star-Gazer, from the favorable position of its eyes for looking upwards, they being placed very near the top of the head. It seldom exceeds 4 inches in length.

Mr. Girard ascertained our Cottus to be an undescribed species from the identical specimen, which I have described here, and he gave it the name of *C. gobioides*, from its strong resemblance to the *Cottus gobio* of Europe. His description of the fish, accompanied by a beautifully engraved figure of it, is contained in his valuable Monograph of the Cottus Family of Fishes, published in the second volume of Smithsonian Contributions to Knowledge.

SMALL-SCALED DACE.

Leuciscus atromaculatus.—Mitch.

Description.—Color of the head and back dark olive-brown; sides lighter, often with bronzy reflections, and passing into a whitish flesh-color on the belly. Dorsal, caudal and outer margins of the pectoral fins, brownish; inner margins of the pectorals, the ventrals and the anal fin, dull orange. Eyes rather small; pupil black, surrounded by a fine golden line; iris brown. Scales small and crowded, as far backward as the ventrals. Lateral line begins at the top of the gill opening, bends rapidly downward over 11 scales, and then runs a straight course to the tail, passing over, in the whole, 60 scales. Tail lunated. Pectoral and ventral fins rounded. A squarish distinct black spot on the anterior part of the base of the dorsal fin.

Length of the specimen described, 6.5 inches; to the pectoral fins, 1.5; dorsal 3; vent, 3.75; anal, 3.9; to base of caudal, 5.5; width between the eyes, 0.6; head, 0.8.

Rays, D. 8, P. 16, V. 8, A. 8, C. 19.

Hiltory.—This is one of the most common fishes of this genus in the western part of Vermont. It abounds almost every where, both in the rivers and small streams. Its insipidity and small size prevent its being sought as an article of food; but, as it takes the hook with great readiness, it affords the boys an opportunity to indulge in the cruel sport of catching them for mere amusement. They are also caught to be used as bait in taking larger fishes.

MASQUALLONGE.

Esox nobilior.—Thompson.

Esox estor, Richardson Fauna Boreali, Part III,—127.
Esox estor, Herbert's Frank Forester's Fish and Fishing.

Description.—Back nearly black; sides bluish gray, mostly covered with irregular roundish dark-brown spots, usually about an inch in diameter, and often confluent, with a few meandering yellowish lines. Belly grayish white, with ruddy tinges. Fins dark brown; pectorals ruddy. Eyes moderately large; pupils black, surrounded by a bright yellow ring, which fades outward over the irides into grayish orange. Length of the specimen before me, 48 inches, from the tip of the under jaw, which is longest, to the extremity of the tail; to the anterior nostril, 4 inches; to the orbit, 5; to the nape, or beginning of the scales, 8; to posterior edge of the preoperculum, 8.5; do. of the operculum, 10.5; the beginning of ventral fins, 24.5; do. dorsal, 31.5; do. anal, 32.5; to the centre of the base of the caudal, 42.75; width between the orbits, 3. Fins: dorsal, length, 5; height 4,—pectorals, length, 1.7; height 5,—ventrals, length, 1.5; height, 4,—anal, length, 4; height 4 5,—caudal, 4 across the base; longest rays, 6.25. Lower part of the cheek, in front of the preoperculum, naked. Face nearly flat between the orbits.

Rays, D. $^{2}18$, P. 16, V. $^{1}12$, A. $^{2}16$, C. $19\frac{5}{5}$.

History.—This fish has, till lately, been confounded with the *Esox estor*, or Common Pike, or Lake Pickerel. When my description of the *E. estor* was published, in 1842, I doubted the existence of this species in our lake, but since that time my mind has changed on the subject. In May, 1847, I received from my friend, the Hon. A. G. Whittemore,* of Milton, a fish caught near the mouth of the river Lamoille, which the fishermen called Masquallonge. It was 26 inches long, and weighed about 6 pounds. Upon examining it, I was fully satisfied that it was of a species distinct from *E. estor*, and, as I could find no description of it under any other name, I made out a description and gave it the name of *Esox nobilior*.

In April, 1848, I received another specimen from the same source, which weighed 19 lbs., and was 41½ inches long. In May, 1849, two specimens were brought along, both caught near the mouth of the Lamoille, one of which weighed 40, and the other 27 pounds. I purchased the latter, and from it the preceding description is chiefly drawn.

Believing this species to attain a larger size, and to be a more excellent fish for the table, than any other epecies of the Pike family, found in the United States, I have given it the specific name of *nobilior*. It is a fish, which is eagerly sought, and commands the highest price in market, but it is rare in Lake Champlain, compared with *E. estor*, or Common Pike. Very good figures of both of these speeies are given in Frank Forester,s Fish and Fishing, but both under wrong names; the *E. nobilior* being figured under the name of *E. estor*, and the *E. estor* under that of *E. lucioides*.

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* Since the above was written, I have received intelligence of the death of my esteemed friend, Albert G. Whittemore, Esq. He was accidentally killed at Zanesville, Ohio, on the 10th of November, 1852, aged 55 years; where he was engaged as contractor on the rail road from that place to Wheeling. He was a gentleman of intelligence and enterprise, and of many estimable qualities as a man and a citizen.

The vulgar name, Masquallonge, appears to have been given by the early French settlers of Canada to the Pikes and Pickerels generally, it being a term, or phrase, descriptive of the whole family, *Masque*, signifying face or visage, and *allonge*, lengthened,—they all having lengthened, or elongated heads. In modern times this name, Masquallonge, has been confined, by the fishermen, to the specics here described, while the other species bear the vulgar name of Pike, or Pickerel. The methods of spelling this Canadian-French name, have been almost as numerous as the authors, who have used it, as may be seen by the following list:

Maskallonge,	Le Sueur.
Masquinongy,	Dr. Mitchell,
Maskinonge,	Dr. Richardson.
Muskallonge,	Dr. Kirtland,
Muskellunge,	Dr. DeKay.

The oldest forms of this name, it will be seen, approach nearest, both in spelling and pronunciation, to the phrase *Masque allonge*, which we have supposed to be its origin, and, therefore, afford presumptive proof of the correctness of our supposition.

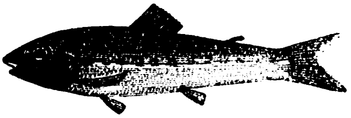
This fish may usually be distinguished from the Common Pike by its dark circular markings, and its more robust proportions. Its head is proportionally shorter, the face flatter and less grooved, and the width across the eyes and upper jaw greater than in the *estor*. But, perhaps, the mark by which it may be most readily distinguished is on the cheek, the lower half of the cheek in the *E*, *nobilior*, in front of the preoperculum, being naked, or without scales, while in the *E. estor* the whole cheek is covered with scales. The difference in the general aspect of the two species may be seen by comparing the figure of the *E. estor* below, with the *E. nobilior* at the head of this article.

Esox estor.—LeSueur.

The specimen here described was a female, with her abdomen filled with eggs, contained in two ovaries, which extended nearly the whole length of the cavity. This fish abounds much more in the streams and smaller lakes in Canada than in Lake Champlain.

GENUS SALMOPERCA.—*Thompson.*

Generic Characters.—Two dorsal fins, the first supported by flexible rays, and the second adipose, as in the trouts. Opercules smooth. A band of fine teeth in each jaw. Scales with serrated edges, as in the perches.



TROUT-PERCH.

Salmoperca pellucida.—Thompson.

Percopsis guttatus, Agassiz Lake Superior, p. 284, and Plate I., fig. 1 and 2.

Description.—General color, light brownish yellow, with longitudinal rows of brown spots, about one-tenth of an inch in diameter, usually one row along the dorsal line, and two rows on each side between this and the lateral line. A broad satin stripe embraces the lateral line. Belly white. Fins and flesh translucent–the vertebral column, the contents of the abdomen, and portions of the head, only appearing opaque, when held towards the light. Fins all large, in proportion to the size of the fish. The rays of the pectorals reach backward half of their length beyond the ventrals, which are attached near the middle of the abdomen, and under a point a little anterior to the first dorsal, and reach backward to the vent. The anal fin has its first ray short and spinous. Caudal fin forked. Nostrils and eyes large; irides yellow. A depression on the head, between the orbits, divided longitudinally by a long ridge. Scales rather large and rough, having finely serrated edges. Length, from 3 to 5 inches. The following are the measurements of one out of three living specimens before me, when the above description was made: Total length, 3.9 inches; to the pectoral fin, 1; to ventral, 1.45; first dorsal, 1.5; anal, 2.1; adipose, 2.6; central base of caudal, 3.2. Fin rays, B. 6, D. $^{2}10$—0, P. 13, V. 8, A. 1|7, C. $18\frac{4}{6}$.

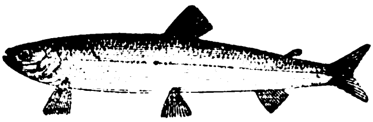
History.—The first knowledge I had of this fish was in the summer of 1841, when I found a specimen of it, 5 inches long, which was dead, and had been drifted up by the waves on the lake shore, in Burlington. On examining it, I found it to possess the adipose and abdominal fins of the trouts, but, in its teeth, gill covers and particularly in its hard serrated scales, to bear considerable resemblance to the perch family. After searching all the books within my reach, without finding it described, I concluded that it might be new, both in genus and species, and accordingly, in allusion to the above mentioned properties, I described it in my journal under the provisional generic name of Salmoperca. A notice of this fish was omitted in my History of Vermont, published in 1842, because I had then only one specimen, and, upon that one, with my little experience, I did not think it prudent to found a new genus and species. When Prof. Agassiz was at Burlington, in 1847, I submitted the above mentioned specimen to his inspection, having at that time obtained no others. At first sight, he thought it might be a young fish of the salmon family, but, upon further examination, he said it was not a salmon, nor any other fish with which he was acquainted.

During the summer of 1847, I found three other specimens of this fish, dead, on the lake shore. One of these I took with me to Boston, in September, to the meeting of the Association of American Geologists and Naturalists, and put it into the hands of my friend D. H. Storer, M. D., with a request that he would ascertain what it was, and let me know.

In May, 1849, I obtained from Winooski river a number of living specimens, which I kept alive for some time; and, observing the great translucency of the living fish, when held up towards the light, I gave it the specific name of *pellucida*, having previously called it, in my journal, *eoceta*, from its wing-like pectoral fins.

About this time I noticed, in the proceedings of the Boston Society of Natural History, that Prof. Agassiz had laid before the Society an account of a new genus of fishes discovered by him in Lake Superior, which he proposed to call Percopsis. Suspecting, from the brief description given of it, that it was identical with my Salmoperca, I wrote to Dr. Storer and inquired of him, if the specimens from Lake Superior, presented to the Society by Prof. Agassiz, were like the one I put into his hands in 1847. He wrote me that he could not say—that the specimen went out of his hands soon after he received it, and he had not seen it since.

In Prof. Agassiz Lake Superior, page 248, I find an account of his genus Percopsis, and his species *P. guttatus*, and I have no doubt that it is identical with my *Salmoperca pellucida*. Still, I have thought it best to let it remain, in this Appendix, under the name I had given.



HERRING SALMON.

Coregonus clupeiformis.—Mitch.

Coregonus artedi.—LeSueur.

Argyrosomus clupeiformis.—Agassiz Lake Superior, p. 339.

Description.—Color of the back bluish brown; sides lighter, with silvery reflections; belly white. Gill covers and cheeks, with silvery and cupreous reflections. Head small, pointed and somewhat flattened above; under jaw longest; mouth small, without teeth; eyes large, round—irides silvery yellow. Scales large and circular. Lateral line distinct, nearly straight, and passes over 72 scales; 13 rows of scales between the first dorsal and the ventral fin—a long slender bract at the base of the ventrals. Pectoral fins long and pointed; ventrals under the anterior part of the dorsal, and triangular; first dorsal nearly midway between the point of the lower jaw and the extremity of the caudal fin; second dorsal adipose and over the posterior part of the anal, and triangular; caudal forked.

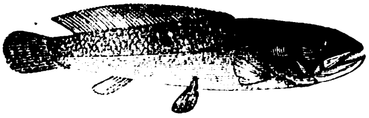
Length, total, 14 inches; to the posterior edge of the operculum, 2.4; to the beginning of the dorsal fin, 6; to the ventrals, 6.2; to the vent, 9; to the anal, 9.3; to the adipose, 10.2; to the central base of the caudal, 12; greatest depth in front of the first dorsal, 2.5; thickness, 1.4. Length of the longest fin rays: first dorsal, 1.6; Pectoral, 1.5; Ventral, 1.4; Anal, 1, and Caudal 2.

Rays, B. 8, D. ${}^{3}10$,—0, P. 4, V. ${}^{1}11$, A. ${}^{1}11$, C. $18\frac{6}{5}$.

History.—This fish is only occasionally met with in Lake Champlain, but they sometimes appear here in myriads. In the spring of 1847, they were, for a short time, taken at Burlington, in very large numbers; as many as 200 being taken at one haul of the seine. In some years none at all are taken here. The specimen from which the preceding description is made was taken in 1848, and I learned of only two others being taken that season. It resembles, somewhat, the Lake Shad, *C. albus*, but is a rounder fish, having much less depth in proportion to its length. It is much esteemed as an article of food. It is common in Lake Ontario and Lake Erie, and is called in many places the Shad Salmon.

GENUS AMIA.—*Linnæus.*

Generic Characters.—Small paved teeth behind the conical ones. Head flattened, naked, with conspicuous sutures. Twelve flat gill-rays. A large buckler between the branches of the lower jaw. Dorsal long. Anal short. Air-bladder cellular, like the lungs of reptiles.



THE BOWFIN.

Amia ocellicauda.—RICHARDSON.

Amia occidentalis.—DEKAY.

DESCRIPTION.-General color above, brown, waved with dull bronzy yellow, approaching to white on the belly, and having the sides sprinkled with yellowish white spots. Pectoral, ventral and anal fins, brownish; dorsal and caudal with alternate bars of brown and brownish white. A large and conspicuous black spot near the upper part of the tail, at the base of the 4th, 5th, 6th and 7th rays of the caudal fin. Head without scales, covered with scabrous bony plates; opercules bony, with membranous edges. Gill-rays flat. Cartilaginous buckler between the branches of the lower jaw. Two short cirri on the upper lip. Eyes moderate, deeply sunken. Jaws broad, rounded and even. A row of sharp conical teeth in each jaw, paved behind with short blunt teeth. Scales large and thin. Lateral line distinct, nearly straight, nearest the back, on the anterior part of the body, crossing 70 scales, which are smaller than those adjacent. Attachment of the caudal fin oblique—caudal rounded. Total length of the specimen before me, 19.2 inches; from the snout to the upper side of the gill-opening, 4; to the beginning of the dorsal, 6.8; to the ventrals, 9; to the anal, 11.5; to the lower edge of the caudal. 15; depth behind the pectorals, 3.6. Width of the head, 3; back of the pectorals, 2.6. Distance between the eyes, and from the orbits to the end of the snout, 1.3 each; between the cirri, 0.6. Length of the dorsal fin, 8.7; height, 1.2,—commences midway between the pectorals and ventrals, and reaches almost to the tail.

Fin Rays, D. 48, P. 17, V. 7, A. 28, C.21.

HISTORY.—This fish abounds upon the muddy bottoms and the marshy coves of the southern part of Lake Champlain. It is very plentiful in the vicinity of Whitehall, and also about the mouth of Otter Creek. From its partiality to muddy bottoms, it has acquired, in many places, the name of Mud Fish. From its resemblance in form to the Ling, it is called in some places the *Scaled Ling.* But its more common appellation in Vermont, is that of *Bowfin.* It attains to considerable size, frequently exceeding two feet in length, and weighing 10 or 12 pounds; but its flesh is soft and ill flavored, very little esteemed as an article of food.

BOTANY OF VERMONT.

Additional to Part I., Chapter VII.

In the first edition of my Gazetteer of Vermont, published in 1824, I gave a simple catalogue of the plants then known to be indigenous, in this state. The materials for that catalogue were derived, principally, from a list of plants growing in the vicinity of Middlebury, prepared by Dr. Edward James, and published, in 1821, in Prof. Frederick Hall's statistical account of Middlebury. The additions to this list were mostly furnished by Dr. William Paddock, Prof. of Botany in the University of Vermont. At that time, very little attention had been given to the scientific botany of the state, and the whole number of plants contained in my catalogue was only 569.

Between 1824 and the publication of my general history of Vermont, in 1842, our state was explored by several eminent botanists from abroad, and by a number of enthusiastic disciples of Linnæus, raised up in our midst, by whose united labors our list of known indigenous plants was greatly enlarged. While engaged in collecting together these scattered materials, for the purpose of making my Catalogue as complete as possible, in the work I was preparing for publication, I was so fortunate as to become acquainted with the late Wm. Oakes, Esq., of Ipswich, Mass. He was at that time engaged in investigating the botany of the western part of Vermont, and he very generously undertook, for me, the systematic arrangement of a complete Catalogue of Vermont plants. I, therefore, put into his hands my former catalogue and all the additional materials, I had accumulated, and the full and beautifully arranged Catalogue in Part I, Chapter VII, is the result of his labor. That Catalogue contains 929 species of Vermont plants, and is an honorable memorial of its

Author, both of his kindness as a friend, and of his zeal and accuracy as a botanist*.

Since the publication of the Catalogue above mentioned, the number of known Vermont plants has been considerably increased, and we have doubtless many more species to reward the labors of botanists. By the kindness of several friends, I am enabled to add to the previous list 105 species, making in the whole 1034.

For the arrangement of these additional species, and for the identification of a large number of them, I am indebted to the kindness of my friend, Prof. Joseph Torrey, D. D., of the University of Vermont.

CATALOGUE OF VERMONT PLANTS.

Continued from page 177, *Part I.*

CLASS I. EXOGENOUS OR DICOTYLEDONOUS PLANTS.

ORDER RANUNCULACEÆ.

Clematis, *Linn.*
    viorna, Wildn. Found at Castleton, by *Mrs. J. Carr.* A very rare species. June, July.
Anemone, *Haller.*
    aconytifolia, Mx. Castleton. *Mrs. J. C.*
Ranunculus, *L.*
    fascicularis, Muhl. Low grounds. Burlington, *T**. Brattleborough, *C. C. Frost.*

ORDER MAGNOLIACEÆ.

Liriodendron, *L.*
    tulipifera, L. A tree not rare in the southern part of this state, fifty years ago. Some large specimens are still left in Bennington county, valley of the Hoosic river. *Mrs. J. C.*

ORDER CRUCIFERÆ.

Nasturtium, *R. Br.*
    hispidum, D. C. Low grounds, Burlington. Also found in Brattleborough, *C. C. F.*
Arabis, *L.*
    lyrata, L. Mountain-garden. Willoughby lake. *C. C. F.* May.
    canadensis, L. Rocks below Winooski Falls; Colchester. *T.* June.
Cardamine, *L.*
    rotundifolia, Mx. In Vermont, locality not specified. *Dr. Robbins.*
    Virginica, Mx. Hill-sides, Vt. *A. Wood.* June.
Sisymbrium, *All.*
    thaliana, Gay. Rocks and sandy fields, Vermont. *A. Wood.* May.
Draba, *L.*
    verna, L. Willoughby lake. *A. W.* May.
Erysimum, *L.*
    cheiranthoides, L. Brattleborough, *C. C. F.*
Isatis, *L.*
    tinctoria. Banks and islands of Winooski river; Burlington, *T.* Probably introduced.

ORDER VIOLACEÆ.

Viola, *L.*
    Selkirkii, Goldie. Rich cedar swamps. Grand Isle. *T.*
    pedata, L. Brattleborough. *C. C. F.* April, May.

ORDER HYPERICACEÆ.

Hypericum, *L.*
    sarothra, Mx. Brattleborough, *C. C. F.* July, August.

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* It is my painful duty here to record the death of my esteemed friend, William Oakes, Esq. He was drowned on the 31st of July, 1848, while passing from Boston to East Boston, under circumstances which left it doubtful, whether by accident, or in a temporary fit of insanity, to which he was subject. He was 49 years of age.

* The authority to which *T.* refers in this catalogue, is *Prof. Joseph Torrey*, of the University of Vermont.

ORDER CARYOPHYLLACEÆ.

Saponaria, *L.*
officinalis, L. Brattleborough, *F.* Banks of Castleton river. *Mrs. J. C.*
Silene, *L.*
inflata, Smith. Brattleborough, *F.* Castleton, *Mrs. J. C.* June.
Sagina, *L.*
procumbens, L. Brattleborough, *F.* June.

ORDER PORTULACEÆ.

Claytonia, *L.*
Virginica, L. Intervale lands in Colchester. Quite distinct from the species *Caroliniana*, Mx., *T.* April, May.

ORDER ACERACEÆ.

Negundo, *Moench.*
aceroides, Moench. Abundant in some localities on the banks of Winooski river, Burlington and Colchester, *T.* April.

ORDER RHAMNACEÆ.

Rhamnus, *L.*
catharticus, L. Bethel, *R. Green.* July.

ORDER LEGUMINOSÆ.

Astragalus, *L.*
Canadensis, L. Burlington, near Red Rocks, *R. Benedict.* July.
Hedysarum, *L.*
boreale, Nutt. Willoughby lake. *A. Wood.* June, July.

ORDER ROSACEÆ.

Sanguisorba, *L.*
Canadensis, L. Brattleborough, *C. C. F.* July.
Rubus, *Tourn.*
Idæus. Cambridge, *Dr. Robbins.* June.

ORDER ONAGRACEÆ.

Epilobium, *L.*
molle, Torr. Intervals, Burlington, *T.* June.
Oenothera, *L.*
fruticosa, L. Willoughby lake, *C. C. F.* August.

ORDER MELASTOMACEÆ.

Rhexia, *L.*
Virginica, L. Brattleborough, *C. C. F.*

ORDER SAXIFRAGACEÆ.

Saxifraga, *L.*
oppositifolia. Willoughby lake, *A. Wood.*
aizoides. Willoughby lake, "

ORDER UMBELLIFERÆ.

Sium, *L.*
lineare, Mx. Burlington, *T.* June and July.

ORDER COMPOSITÆ.

Diplopappus, *Cass.*
linarifolius, Hook. Brattleborough, *C. C. F.* September.
Sericocarpus, *Nees.*
solidagineus, Nees. Brattleborough, " July.
Aster, *L.*
radula, Ait. Brattleborough, " July.
elodes, T. & G. Brattleborough, " July.
cyaneus, (var.) Brattlebbrough, " July.
amethystinus, Nutt. Brattleborough, " August.
sagittifolius, Ell. Brattleborough, " September.

Solidago, *L.*
rigida, L. Burlington, *T.* August and September.
stricta, Ait. Burlington, *T.* August and September.
serotina, Willd. Burlington, *T.* August and September.
patula, Muhl. Burlington, *T.* August and September.
thyrsoides, Meyer. Willoughby lake, *A. W.* Mansfield mountain, *W.*
Muhlenbergii, T. & G. Brattleborough, *C. C. F.* August.
corymbosus. Willoughby lake, *C. C. F.* August.
Artemisia, *L.*
Canadensis, Michx. Willoughby lake, *A. W.*
Rudbeckia, *L.*
hirta, L. Brattleborough, *C. C. F.* July.
Helianthus, *L.*
frondosus, (var.) Brattleborough, *C. C. F.* July.
trachelifolius, Willd. Brattleborough, *C. C. F.* August.
Hieracium, *L.*
Gronovii, Tourn. Colchester, *T.* Brattleborough, *C. C. F.* July.
scabrum, Michx. Brattleborough, *C. C. F.* August.
Cirsium, *Tourn.*
horridulum, Michx. Brattleborough, *C. C. F.* July.
Cichorium, *Tourn.*
Intybus, L. Burlington, in the lanes, *Mrs. A. P. Judd.* August.

ORDER LOBELIACEÆ.

Lobelia, *L.*
Dortmanna, L. Willoughby lake, *A. W.* July.

ORDER ERICACEÆ.

Andromeda, *L.*
ligustrina, Muhl. Brattleborough, *C. C. F.* June.

ORDER AQUIFORDELELIACEÆ.

Prinos, *L.*
laevigata, L. Mouth of the Winooski, Burlington, *T.* June.

ORDER ASCLEPIADACEÆ.

Asclepias, *L.*
purpurascens, L. Brattleborough, *C. C, F.* June.
variegata, L. Brattleborough, " July.
verticillata, L. Brattleborough, " July.

ORDER BORAGINACEÆ.

Myosotis, *L.*
stricta, Link. Brattleborough, *C. C. F.* June.
Symphytum, *L.*
officinale, L. Pownal, *T.* Introduced. July.

ORDER LABIATÆ.

Pycnanthemum, *Michx.*
linifolium, Pursh. Brattleborough, *C. C. F.* July.
aristatum, Michx. Brattleborough, " August.
Trichostema, *L.*
dichotoma, L. Brattleborough, " August.

ORDER SCROPHULARIACEÆ

Verbascum, *L.*
blattaria, L. Burlington, *T.* Brattleborough, *C. C. F.* July.
Ilysanthus, *Rafinesque.*
gratioloides, Benth. Brattleborough, *C. C. F.* July.
Pentstemon, *L'Her.*
laevigatum, Soland. Burlington, Red Rocks, *T.* August.

ORDER LENTIBULACEÆ.

Utricularia, *L.*
inflata, Walt. Brattleborough, *C. C. F.* August.

ORDER PRIMULACEÆ.

Primula, *L.*
Mistassinica, Michx. Willoughby lake, *A. Wood.*

ORDER PLANTAGINCÆ.

Plantago, *L.*
lanceolata, L. Burlington, *T.* July.
Virginica, L. Brattleborough, *C. C. F.* July.

ORDER POLYGONACEÆ.

Polygonum, *L.*
erectum, L. Burlington, *T.* Brattleborough, *C. C. F.* July.
punctatum, Ell. Brattleborough, *C. C. F.* July.
Rumex, *L.*
sanguineus, L. Brattleborough, *C. C. F.* July.
aquaticus, L. Brattleborough, " July.

SUB-ORDER MYRICEÆ.

Myrica, *L.*
gale, L. Wells, border of the pond, *T.* July.

CLASS II. GYMNOSPERMS.

ORDER CONIFERÆ.

Cupressus, *Tourn.*
thyoides, L. Willoughby lake, *C. C. F.* May.
Juniperus, *L.*
Sabinus, L. West Rutland, *Mrs. J. C.*

CLASS III. ENDOGENS OR MONOCOTYLEDONS.

ORDER AMARYLLIDACEÆ.

Hypoxis, *L.*
erecta, L. Brattleborough, *C. C. F.* June.

ORDER ALISMACEÆ.

Sagittaria, *L.*
lancifolia, (var.) Burlington, *T.* Brattleborough, *C. C. F.* July.
natans ? Brattleborough, *C. C. F.* July.

ORDER XYRIDACEÆ.

Xyris, *L.*
Caroliniana, Walt. Brattleborough, *C. C. F.* August.

ORDER RESTIACEÆ.

Eriocaulon, *L.*
decangulare, Michx. Willoughby lake, *A. W.*

ORDER PODOSTEMACEÆ.

Podostemon, *Michx.*
ceratophyllum, Michx. Brattleborough, *C. C. F.* July.

ORDER FLUVIALES.

Potamogeton, *L.*
praelongus, Wolff. Willoughby lake, *A. W.* July.
oblongus. Brattleborough, *C. C. F.* July.
pulcher. Brattleborough, *C. C. F.* July.
hybridus, Michx. Brattleborough, *C. C. F.* July.
spiralis. Brattleborough, *C. C. F.* July.

ORDER CYPERACEÆ.

Rhyncospora, *Vahl.*
alba, Vahl. Burlington, *T.* August.

Carex, *Micheli.*
lanuginosa, Michx. Burlington, *T.* July and August.
folliculata, L. Burlington, *T.* July and August.
angustata, (Boot.) Burlington, *T.* July and August.
filiformis, Linn. Burlington, *T.* July and August.
striata, Michx. Burlington, *T.* July and August.
dioica, L. Burlington, *T.* July and August.
scirpoidea, Schk. Willoughby lake. July and August.

ORDER GRAMINEÆ.

Koeleria, *Pers.*
Pennsylvanica, D. C. Burlington, *T.* July.
Oryzopsis, *Michx.*
melanocarpa, Muhl. Willoughby lake.
Aira, *L.*
atropurpurea, Wahl. Mansfield mountain, *T.* August.
Lolium, *L.*
perenne, L. Willoughby lake, *C. C. F.*
Muhlenbergia, *Schreb.*
sylvatica, T. & G. Willoughby lake, *C. C. F.*

CLASS IV. ACROGENS.

ORDER FILICES.

Isoetes, *L.*
lacustris, L. Brattleboro, *C. C. F.*
Woodsia, *R. Brown.*
glabella. Willoughby lake.

GEOLOGY OF VERMONT.

Geological Survey.

In my Preface to the Natural, Civil and Statistical History of Vermont, it was stated that Chapter VIII, Part I., remained to be written, after a Geological Survey of the state should be effected. Little did I then think that ten years would be suffered to pass away, and so desirable a work remain unperformed. But such is the fact; and I am, therefore, yet under no obligation to redeem my pledge, to write that chapter. But since, within those ten years, a Geological Survey of the state was *begun*, and since, through that beginning, and other means, important geological facts have been brought to light, I shall here give a brief history of the labors, which have been performed, and a brief sketch of the knowledge of our geology which has been acquired.

The first state Geological Survey, prosecuted under legislative authority, was, I think, authorized by North Carolina, in 1823. In 1824, the legislature of South Carolina authorized a geological survey; and in 1830 provision was made for a geological survey of Massachusetts, under the authority of that state. The execution of the survey of Massachusetts was committed to Professor, (now President), Hitchcock, of Amherst College, and was prosecuted with so much ability and success, that most of the other states followed the example, and authorized surveys.

In the execution of these surveys, and in the publication of the results, the state of New York has, by far, outdone any of the other states. The plan of the New York survey embraced, not only the Geology and Mineralogy of the state, but also the Botany and Zoology; and ample provision was made for carrying out that plan. The corps of surveyors embraced four distinguished geologists, one mineralogist, one palæontologist, one botanist and one zoologist, with their respective assistants. Arrangements were made for commencing the work in 1836, and, after five years of incessant labor, in 1842, several volumes of the Final Reports were in readiness for publication, which, with other volumes afterwards prepared, have since been published. These reports are published in large quarto form, on excellent paper, and fully illustrated with excellent engravings. Eighteen volumes have been published, five of which are devoted to zoology, four to geology, four to agriculture, one to mineralogy, two to organic remains, and two to botany.

The subject of a Geological Survey of Vermont was first brought before the legislature of the state in 1836*. In 1837 the subject was referred to the committee on education, in behalf of which, Professor Eaton submitted to the Senate a very able Report, accompanied by several important documents. The report closed by recommending the passage of a resolution, ordering the report and documents to be printed and circulated among the people of the state, and by expressing the belief that, upon due consideration, the popular voice would be in favor of providing for the survey at the next session of the legislature. In 1838, the subject was again taken up, discussed and dismissed, without any provision being made for commencing the survey; and nearly the same process, with the same result, was repeated at each succeeding session of the legislature down to the year 1844, when a bill, authorizing a Geological Survey of the state, was finally passed, in the Senate, by 20 yeas to 7 nays, and in the House, by 96 yeas to 92 nays, and received the Governor's approval.

This act authorized and directed the Governor to appoint a competent State Geologist, who should have power, with the Governor's approbation, to appoint the necessary assistants, fix the amount of their compensation, and direct their labors. It made it "the duty of the State Geologist, as soon as practicable, to commence and prosecute a geological and mineralogical survey of the state, embracing therein a full and scientific examination and description of its rocks, soils, metals and minerals," and report to the Governor, annually, on the 1st day of October, the progress of the work. For the purpose of carrying the provisions of this act into effect, the sum of $2,000 annually, for the term of three years, was appropriated.

His Excellency, William Slade, Esq., being Governor, upon him devolved the appointment of the State Geologist, and the arrangements, on the part of the state, for carrying the contemplated survey into effect. After some time spent in deliberation and inquiry, he finally commissioned Charles B. Adams, at that time Professor of Chemistry and Natural History in Middlebury College, the State Geologist, who was to enter upon his duties on the 1st day of March, 1845†.

In arranging the details of the survey, it was provided that, so far as should be found practicable, eight suites of specimens of all the rocks and minerals should be collected, trimmed and ticketed. These specimens, when the material admitted, were to be three inches square, and from one to two inches thick. The destination of these suites of specimens were as follows:—one, (and the best, where there was a choice,) for a state collection at Montpelier; one for the University of Vermont; one for Middlebury College; one for Norwich University; one for each of the Medical Colleges, at Castleton and Woodstock; one for the Troy Conference Academy, at Poultney, and one to be the property of the State Geologist.

With the approbation of the Governor, the State Geologist appointed the Rev. S. R. Hall and Z. Thompson, general assistants in the field labor, and Dr. S. P. Lathrop, assistant in the depot of specimens, and in occasional field services. The field labors were commenced as soon as the advancement of the season would permit, which was early in May, and were prosecuted during the summer with unremitted diligence. The labors of the general assistants were confined to the northern half of the state; and, during their four months' services, they together, or separately, visited and explored, more or less thoroughly, about 110 townships. The State Geologist, with Dr. Lathrop and other occasional assistants, labored, for the most part, in the southern half of the state. During the season, about 6,000 specimens were collected and forwarded to the depot, in Middlebury. These were mostly trimmed, ticketed and catalogued, in the course of the following winter.

During the years 1846 and 1847, the business of the Survey was diligently prosecuted by the State Geologist, and the assistants were employed, for several months in each summer, in field labors. At each session of the legislature reports were made to the Governor, of the progress of the work; and these annual reports were published and circulated among the people.

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* See Part II., page 104.

† Since the above was written, I have received the painful intelligence of the death of my esteemed friend, Prof. Charles B. Adams. He died of fever, on the 19th of January, 1853, on the island of St. Thomas, W. I., whither he had gone for the double object of improving his health and furthering himself in his favorite pursuits of Natural History. In the death of Prof. Adams, the scientific world has lost a most indefatigable and successful laborer. During the last ten years, few individuals have done more than he did, for the advancement of the natural sciences. By his contributions to Conchology, and his minute investigation of the geographical distribution of mollusks, he has erected to himself an honorable monument; and, although removed by a mysterious Providence, in the prime of life, and in the midst of his usefulness, his name will long be cherished by his personal friends, and will be handed down to future generations, deeply engraved upon the records of science.

But they were by no means intended to exhibit the entire results of each years' labors, but merely to indicate the advancement of the survey, and to furnish such general information as would enable the people of the state rightly to understand, and duly to appreciate those results, when they should be collected and systematised in a Final Report.

Before the close of the third year, for which provision had been made by the act of the legislature authorizing the survey, the State Geologist was appointed a Professor in the College at Amherst, Mass. Believing that the remaining field labors, for the completion of the survey, would be finished during the next season, and that he should derive much aid in the preparation of the Final Report, from the collections and library at Amherst, he deemed it his duty to accept the professorship offered him ; but he did it, with the expectation that he would not be required to enter fully upon the duties of the professorship, until he had completed the survey and prepared his Final Report, and that our legislature would make the appropriations necessary for those purposes.

At this time, only a part of the specimens, collected from the various sections of the state, had been trimmed, ticketed and sent to the institutions for which they were designed. The remainder, embracing those which had been ticketed for the state cabinet, were in the depot at Middlebury. Anticipating legislative provision at the next session, for the completion of the work as above mentioned, the State Geologist directed his assistant, at Burlington, to obtain, at that place, a suitable room, or rooms, to serve as a depot for the tools, fixtures and untrimmed specimens ; which being done, the articles, amounting to several tons, were forwarded from Middlebury and placed in it. In doing this, he reserved the principal fossils and the specimens ticketed for the state cabinet, which he, soon afterwards, took with him to Amherst, that they might be at hand, for examination and reference, while preparing his final Report.

At the session of the legislature, in Oct. 1847, the subject of the survey was taken up, but no appropriation was made, either for its continuance, or for the preparation of a Final Report.

In 1848 the subject was again taken up, but with no better success, and all that was done in relation to it, was the passage of a resolution, directing the Governor to employ some person to get back into the state, the materials and manuscripts, belonging to the Survey, and place them in the charge of the State Librarian, at Montpelier. That duty the author of this work had the honor of discharging, in the summer of 1849, and his report to the Governor, was published in the Appendix of the House Journal, for that year. Since 1849, the subject of the Survey has, once or twice, been called up in the legislature, but nothing further has been done. The untrimmed and unticketed specimens are lying, packed in boxes, at Burlington, with a portion of the tools and fixtures ; and the remainder are in charge of the State Librarian at Montpelier, and all these are fast losing their value.

The Geological Survey of the state, having been suspended before the examinations were completed ; and the results of the labors performed, having never been collected together and systematically arranged, a full and satisfactory account of our Geology cannot yet be expected ; and all that will now be attempted, is a hasty sketch of the general geological features of the state. There are important scientific questions, which an accurate knowledge of the geology of Vermont would, doubtless, very much aid in solving, but the acquisition of this knowledge will require much additional patient investigation and research ; and the discussion of these questions, would require more space than could be afforded to the subject in this Appendix.

Champlain Rocks.

We shall begin our sketch of Vermont Geology at the western border of the state, and, proceeding eastwardly, give some general account of the different rock-formations in their order.

The rocks which occupy the lowest parts of the valley of Lake Champlain belong to that division of the Palæozoic rocks, denominated, by the New York geologists, the *Champlain Group*. Beginning with the oldest and most westerly, these rocks are arranged in the following order :

1. Potsdam Sandstone.
2. Calciferous Sandstone.
3. Chazy, or Isle la Motte Limestone*.
4. Trenton Limestone.
5. Utica Slate and Hudson River Shales.

The *Potsdam Sandstone* is largely developed at several places on the west, or New York, side of Lake Champlain, but is no where found *in situ*, within the limits of Vermont. The remarkable Chasm, through which the river Ausable passes, near Port Kent, is in this rock.

Calciferous Sandrock.—This, the second member of the Champlain group, appears on the Vermont side of the lake, but very sparingly. It is seen at the base of the uplift of Snake mountain, in Addison county, and in a few other places.

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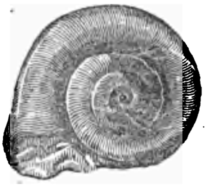
* This division embraces the Chazy and Bird's eye limestone, and Isle la Motte marble of the New York Geologist.

Chazy, or *Isle la Motte Limestone*.—This is the most important member of the Champlain group, and the oldest, which is in much force in Vermont. This rock forms the principal part of the Isle la Motte, the western part of Grand Isle and the eastern shore of the lake, from Charlotte southward. It usually lies in thick, even-bedded strata, dipping, for the most part, slightly towards the east or northeast. It is of a close, compact texture, easily broken into regular blocks, and easily sawed, or hammered, and yet sufficiently strong to serve as the very best of building stone. It constitutes, in many places, the shore of the lake, and is in a position highly favorable for quarrying, and for transportation by water. Quarries of this limestone have been opened in various places, and it is extensively used for building and other purposes. Some of the best of these quarries are on the Isle la Motte; and among these, Fisk's quarry, on the west side of that island, is probably the most interesting and valuable. This quarry rises directly on the lake shore, and lies but a few rods from the usual line of steamboat navigation through the lake; and the shore is here so bold that the largest vessels on the lake may safely approach it within a few feet, and a very good landing is constructed. The quarry presents a working breast, rising about 35 feet above the lake. The strata vary somewhat in their aspect, but they are, in general, of a bluish gray color. The thickness of the strata, varies from eight inches to five or six feet, and each stratum preserves its thickness with great uniformity. The general dip of the strata is about 4° towards the north east.

Other excellent quarries have been opened on this island, of which Hill's quarry, and the Black Marble quarry, on the east side, are the most important. The Isle la Motte limestone, obtained at these quarries, and at others along the shore of the lake, is already extensively used in the construction of buildings and rail road bridges, and considerable quantities are sawed for hearths, or for being polished as marble. The black marble takes a very fine polish, and some of it is exceedingly beautiful. The surfaces of the natural seams and fractures of the strata of this marble, are frequently covered with a black, often iridescent, glazing, resembling the surface of anthracite, and it is probably carbonaceous.

The Isle la Motte limestone abounds in fossils, among which, species of Maclurea, orthoceras and corals are conspicuous, being seen in the worn and weathered surface of the rocks, in great numbers.



Maclurea magna.

This cut represents the Maclurea magna, as it appears on the worn surfaces of the rocks, on the Isle la Motte, and at most places where the rock is found. The Maclureas are spiral shells, resembling in form our little fresh water shell called the Planorbis, but they grow to a very large size. When in the surface of the rock, and about half worn away, they frequently present a spiral coil, eight or ten inches in diameter, sometimes having so much resemblance to serpents coiled up, that the early settlers in the valley of Lake Champlain, regarded them as *petrified snakes*.

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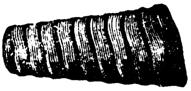

Orthoceras.

This cut represents the general form of the Orthocerata, as they appear in the weathered surfaces of the Isle la Motte limestones. The number of species found in this formation is very great, and the number and magnitude of the individuals, accumulated at some localities, is remarkably so. At some places on the Isle la Motte the rocks, for rods in extent, and several feet in thickness, seem to be made up almost wholly of Orthoceras, closely packed together in a limestone cement. Some of these are 18 or 20 inches long and 6 or 8 inches in diameter at the larger end. The interior of these shells is usually filled with calcareous spar, but they are sometimes found empty.

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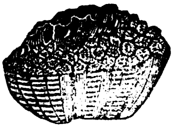

Columnaria alveolata.

Several species of coral are found in this limestone. Some of these have a structure resembling that of honey comb, and hence they have been supposed, by persons ignorant of geology, to be honey-comb petrified. Like the coral reefs, which are now in the process of formation in many parts of the ocean, they are the work of minute insects called *zoophytes*.

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The *Trenton Limestone*.—This lies next in the ascending series. It occupies only a small extent of territory in Vermont, but is every where recognized by its characteristic fossils. From near the south end of the lake it extends northward as far as

Charlotte, showing itself in the uplifts, at various places. It appears again in South Hero, and extends northward, through the western part of Grand Isle, and constitutes the south eastern and highest parts of the Isle la Motte. It also caps some of the elevations near the Medicinal Spring, in Highgate.

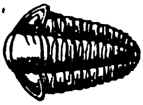
This rock is sufficiently compact and firm, in some places, to serve as a building stone, but it is, for the most part, thin bedded and shaly, and of very little value, excepting that it forms the basis of a good soil.

The species of fossils in the Trenton Limestone are exceedingly numerous. In the single genus, orthis, they amount to no less than seventeen, which are peculiar to this rock; and in many other genera the species are nearly as numerous. In Grand Isle, this limestone is rather thick bedded, is of a light gray color, and almost entirely made up of shells of the orthis. This stone, when the edge of the stratified mass was exposed to the heat, was found, unlike most limestone, to withstand the action of the fire, and, on that account, it was much used by the early settlers, for the construction of fire-places, on which account it is still distinguished by the name of *fire stone.*

This figure exhibits the general form of an Orthis.

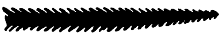
Utica Slate and Hudson River Shales.—Still higher, and to the eastward of the Trenton Limestone, lie a series of black slates. Some of these slates are rather thick bedded, are quite calcareous, and break with conchoidal fracture, and, lying immediately above the Trenton Limestone, are in some cases, with difficulty, distinguished from it. In other parts, the slaty laminæ are quite regular, and readily separated. But far the greater part of it appears to be crushed and broken into wedge-shaped masses, interspersed with seams of calcareous spar. In many places, these wedge-shaped shaly masses are covered with glazing, giving them the lustre and appearance of anthracite. So strong is this resemblance to coal, that many have supposed that there must be coal beneath it, and considerable excavations have been made in it with the vain hope of finding it.

These shales are the only rock in the place, in Alburgh; they form nearly the whole of North Hero, the eastern half of Grand Isle, Rock Dunder, Juniper Island, and most of the other small islands; and it forms the bank of the lake, along the east side, throughout almost its entire length. With the exception of that portion of them which lies next to the Trenton Limestone, these shales are totally useless as a building stone. They, however, disintegrate into a black, rich soil, and are a valuable material for making roads.



Tribolite.

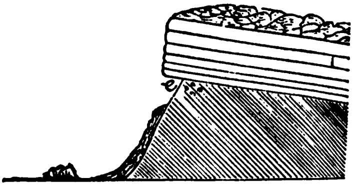
Trilobites are occasionally met with, particularly in the older portion, which has been sometimes separated from the other shales, under the name of Utica Slate, as well as in the Isle la Motte Limestone, before described.



Graptolites.

Graptolites are common in some few places, but as a whole, these shales are quite barren of fossils. The above cut will furnish some idea of the general appearance of graptolites. It pretty nearly represents *Graptolites amplexicaule*, found in the Trenton Limestone.

Red Sandrock.—The next series of rocks, lying above and to the eastward of shales, has been generally known in the neighborhood, as the Red Sandrock formation. This rock extends from south to north nearly the whole length of Lake Champlain. It makes its appearance in uplifts, presenting mural precipices towards the west, with a dip from 5° to 30° towards the east. Its western limit is marked by a series of considerable hills, which are at some little distance from the lake shore at the south and in the northern part of Franklin county; but from Shelburne to St. Albans Bay, it lies, for the most part, along the shore of the lake. Sugar Loaf and Glebe Hill, in Charlotte, Red Rocks and Lonerock points, in Burlington, and Mallet's Head, in Colchester, belong to the same line of uplifts. The accompanying cut represents a section passing through the uplift at Lonerock Point, where the thick bedded sandrock is seen resting on black glossy shales.

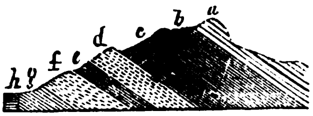


The shale, here, has been washed out from under the sandrock, large masses of which have broken off by their weight and fallen into the lake. These, excepting one, are covered, when the lake is high, but that one is seen at all times, and from all points of view, to stand prominently out of the water; hence the name, *Lone-rock*

Point. We are aware that it has been generally called *Sharpshins*, but we think that it is quite time that vulgar name was discarded.

Towards the northern part of this uplift there commences a bed of dove-colored limestone, between the shale and the sandrock, which appears with increasing thickness at Mallet's Head and St. Albans Bay; and at Swanton is quarried for marble. From Swanton it continues northward into Canada.

One of these uplifts, that of Snake Mountain, affords a fine exhibition of all the members of the Champlain Group of rocks, which we have been describing, as may be seen by the section below, which is copied from Prof. Adams' Second Annual Report on the Geology of Vermont, p. 163.



a. Red Sandrock, forming the summit of the mountain, with an easterly dip of 20°.
b. Debris from the Red Sandrock.
c. Hudson River Shales, considerably covered with drift and debris.
d. Utica Slate.
e. Trenton Limestone.
f. Isle la Motte Limestone.
g. Calciferous Sandstone.
h. Clay.

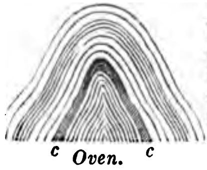
The rocks, which constitute the Red Sandrock series, differ very much in color, and in composition, or lithological character. The lower strata are, in many places, considerably calcareous, and thick-bedded, with the planes of stratification so much obliterated, as to give them the appearance of an igneous, or unstratified rock. The color of this portion is often gray, or variegated with different shades of brownish red and yellowish white; and parts of it are sufficiently calcareous to admit of being polished, and make a very compact and beautiful variegated marble. The best specimens of this have been found in boulders in connexion with the drift.

The middle portion of this series is almost entirely siliceous, and, through a great part of its extent from south to north, is of a dark reddish brown color; and it is the color of this portion which has given the name of Red Sandrock to the series. But in some places, this middle portion is nearly destitute of coloring matter, appearing as a light gray stratified quartz rock. In some places it is so purely siliceous as to be suitable for the manufacture of glass. Cases also occur, where a stratum of pure white quartz intervenes between strata which are highly colored. There is an example of this in Willard's quarry, in Burlington.

The colored strata of this sandrock furnish a very durable and beautiful stone for foundations and underpinnings of buildings, and, though somewhat refractory and difficult to work, has been very much used for that purpose. The foundations of the greater part of the buildings in Burlington, are of this material.

From the middle portion of the Red Sandrock series, the strata become more and more calcareous, in proceeding upward and eastward, till they, at length, become in many places a very pure limestone. This limestone is, generally, of a bluish color; but in some places, particularly in the eastern part of Shelburne, its color is pure white. Portions of this limestone make the very best of quicklime, which is largely manufactured from it, not only for use in the neighborhood, but for transportation into the interior of the state, and to places where no good limestone exists*. At Penniman's quarry and kilns, which are by the side of the railroad above Winooski Falls, Messrs. Penniman & Catlin manufactured, in 1852, about 67,000 bushels of quicklime, and others, in the neighborhood, manufactured about 40,000 bushels, making over 100,000 bushels, the principal part of which was sent by railroad into the central and eastern parts of the state, and to other parts of New England.

Some portions of the Red Sandrock series are very regularly and handsomely stratified, but other portions are much disturbed and broken, or bent and folded. One of the most interesting plications in this rock, which have been noticed, is in Monkton. The south end of this plication is represented in the figure below.



The white spaces between the curved lines represent the edges of the strata. These are all of the ordinary sandstone. The broad dark stratum, *c c*, is argillaceous slate, having the laminæ nearly perpendicular to the plane of deposit. The upper portion of this, which is left wholly dark, has been removed, forming the cavity called *the Oven.*

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* The good qualities of the quicklime manufactured from this stone is not only attested by those, who have used it in this country, but has been fully acknowledged, by competent judges, abroad. In 1851, U. H. Penniman, Esq., sent out a cask of his lime for exhibition at the World's Fair, in London. This lime was examined, by a Jury, appointed for that purpose, under the royal commission, and this jury awarded him a Prize Medal and Certificate, as testimonials of its superior excellence, placing it in the first rank in competition with the world.

The portion represented in the cut, is about 30 feet broad at the base.

The general strike of the Red Sandrock formation is about N. 20 E., and the dip varies from 4° to 25° or more. Its width, from east to west, is very variable, but will average, perhaps, five miles.

This rock is very barren in fossils, and those found are very obscure, consisting of fucoidal layers, and fragments of crinoidea and trilobites. Marks of rain-drops, and wave and ripple marks are very common, and well defined. The fragments of trilobites have been found most abundant in this rock in Highgate, but they are there so much decayed, and so obscure, that it is very difficult to determine the species.

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TACONIC ROCKS.

Under this name have been embraced the rocks in the southern half of the state, which lie to the eastward of the Champlain group, and to the westward of the main ridge of the Green Mountains. They occupy a large part of the counties of Bennington, Rutland and Addison. They derive their name from a range of high lands, which extend from the western part of Massachusetts into Vermont, and which are called the *Taconic Mountains*. The true geological position and character of these rocks is not yet well settled. While some regard them as primary, and others as metamorphic silurian rocks, Prof. Emmons, and some others, have maintained that they are a distinct group of palæozoic rocks, which are older than the Potsdam Sandstone, which is the oldest member of the Champlain group.

The Taconic group of rocks consists of Roofing Slates, Sparry Limestone, Magnesian Slates, Stockbridge Limestone and Granular Quartz.

Roofing Slate.—The roofing slate of this formation is found principally in the western part of Rutland county, particularly in the towns of Castleton, Poultney and Fairhaven. Some sixteen or eighteen slate quarries have already been opened in these towns, many of which yield slate of a very superior quality. There are two principal varieties of the slate, one of which is of greenish color, and the other reddish brown. Several of the quarries have been opened very recently, and have not yet yielded a large amount. The yield of all the quarries above mentioned, in 1852, was estimated to exceed 10,000 squares, and the annual yield will doubtless go on increasing, from year to year, indefinitely. It already finds its way, not only to Boston and New York, but to Buffalo, Cleveland, and other cities at the west.

Sparry Limestone.—This rock stretches through the western parts of the counties of Addison and Rutland. It is divided and checked by numerous beds of calcarious spar. Its color is bluish, or gray of different shades.

Magnesian Slates.—These slates lie to the eastward of the roofing slates and sparry limestone, and to the westward of the Stockbridge limestone. They sometimes alternate with the latter, as the two former do with each other. They are most fully developed in the northwestern part of Bennington county, and southwestern part of Rutland county.

The magnesian slates are usually of a light grayish color, and often of a greenish hue. They, in many places, are easily split into broad flat masses, the surfaces of which often have a pearly lustre, and an oily feel. But for the most part, these slates are largely filled and checked with veins and seams of white quartz.

Stockbridge Limestone.—In an economical view, the Taconic group probably furnishes the two most valuable rocks in the state, excepting only the Isle la Motte Limestone; and these two are, the roofing slate, already mentioned, and the Stockbridge Limestone.

Commencing at the south line of the state, in Pownal, the Stockbridge Limestone forms a belt, which extends northward through the counties of Bennington, Rutland and Addison, as far as the town of Monkton. This belt is, on an average, nearly five miles wide, having the Magnesian slate on the west, and a range of Granular Quartz on the east. To the northward of Bennington county this rock occupies, for the most part, the valley of Otter Creek.

This range of limestone furnishes, through almost its entire extent, an abundance of excellent marble. Its color is generally light, varying from dove color to the purest white, Some portions of it are of a light flesh-color, and others are beautifully variegated ; and at several places a very good statuary marble is found. Stephenson's statue of the wounded Indian, which was exhibited at the World's Fair, in London, was made from Vermont marble, obtained, I think, from a quarry in Rutland.

Marble quarries, at various places in the Stockbridge Limestone, have been more or less worked for many years. The principal of these are in the towns of Dorset, Rutland, Pittsford, Brandon and Middlebury. The great expense of transportation, for a long time prevented these quarries from being extensively worked, but the construction of railroads, along the whole line of this formation in Vermont, has opened easy outlets for the marble, and already largely increased the marble business. We have not room in this Appendix to go into particulars with regard to the yield of the various quarries. There is no doubt but that the marble business is destined to be one of the most important resources of the state.

Granular Quartz.—This forms a narrow range, or belt, extending from the south line of the state to the northern part of Addison county, between the Stockbridge limestone on the west, and the rocks of the Green Mountains on the east. This range is quite irregular, and in some places not easily traced. It is mostly of a dark gray, or brownish, color, and is very barren in minerals, containing only occasionally crystals of sulphuret of iron and schorl.

The Taconic rocks, generally, contain few interesting minerals ; and the fossils which have been found in them are very few and obscure. These rocks have, for the most part, a steep eastern or southeastern dip.

All the rocks, in place, in Vermont, lying to the eastward of the Champlain and Taconic groups, already mentioned, and occupying more than three-fourths of the state, have, till recently, been regarded as primary ; but facts are daily coming to light which render it probable that the greater part of them belong to the palæozoic, or silurian series, and that they have been changed, and have had their fossils nearly all obliterated by heat. We shall not enter at all into the discussion of the geological age of these rocks, but confine ourselves to a hasty general description of them.

In a former work* I have regarded these rocks as primary, and have described them as belonging to two grand divisions, which are distinguished from each other by very obvious characteristics. The first of these divisions, lying next eastward of the rocks already described, and constituting the main central body of the Green Mountains, was denominated the *Telcose slate formation*, or division, from the general prevalence of that rock, particularly in the northern portion of it. The other division, extending eastward from this to Connecticut river, was called the *Calcario-mica slate formation*. The line between these formations is, for the most part, well defined and easily traced, from south to north, through the whole length of the state. From the south line of the state, in Halifax, it runs in a direction nearly north through the towns of Newfane, Cavendish, Bridgewater and Bethel, to Northfield, and thence a little east of north through Montpelier, Calais, Craftsbury and Irasburgh, to Memphremagog lake.

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Talcose Slate Division.

This division, which constitutes the central portion of the Green Mountains, varies in width from about 14 miles, in the south part of the state, to 30 miles in the northern, and it embraces the loftiest mountain summits in the state.

The rocks of this division, though, generally, more or less talcose, vary considerably, in their aspect and composition. Beginning in the northerly part of the state, with the rocks next eastward of the Red sandrock formation, we find them shaly, very quartzose, and with very little talc or mica in their composition. They have a dip of about 40° to the east, and in some places the beds, or strata, are a fine conglomerate, the rounded pebbles being, for the most part, quite minute. In some parts the rocks have a greenish, or chloritic hue, and are so thick bedded and compact, as to make a very good building stone. This is particularly the case in the towns of Jericho and Westford.

In proceeding eastward the dip of these rocks increases rapidly, till it becomes vertical along the western foot of the Green Mountains, forming a synclinal axes. The line of this axis passes through the towns of Berkshire, Enosburgh, Bakersfield, Cambridge, Underhill and Jericho. To the eastward of this line the dip continues nearly vertical for several miles, being sometimes to the west, and, at others, to the east, forming a succession of synclinal and anticlinal axis. The dip then becomes uniformly westward, and continues so through the eastern part of the formation.

Interstratified with the Talcose Slate, we frequently find well characterized clay and mica slates ; and in many places along the slopes of the Green Mountains, the talc and mica enter into the composition of the same slates in such equal proportions as to make it difficult to say which name more properly belongs to it. In Berkshire and Enosburgh there are extensive beds of well characterized clay slate, portions of which may hereafter be found suitable for roofing. A little further east, in Richford, is a narrow range of plumbaginous slate, which has been traced southward as far as Huntington, in the south eastern part of Chittenden county. In Cambridge, it is found sufficiently soft and black to form a tolerable substitute for black lead.

In many places along the western slope of the Green Mountains, the rocks lie in thick beds, or strata, each stratum splitting with nearly equal facility in all directions, and approaching to gneis in appearance and composition; and it has been proposed to denominate the rocks, which constitute this great axis of the Green Mountains, *Green Mountain Gneis.*

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* Geography and Geology of Vermont, for Schools.

The rocks embraced in our Talcose Slate Division, in the southern part of the state, are much less characteristic, than in the northern, and the different varieties of rock are much more broken and jumbled. No true granite or gneis have been observed in this formation, in the northern half, but both these rocks show themselves in the southern half, in various places. With the exception of a few small patches at the south, and three or four thin beds of saccharoid limestone, at the north, there are no rocks which contain any sensible amount of lime, in the whole territory embraced in what we have called the talcose division, and which constitutes about one-third of the whole surface of the state. Quartz is the great mineral element of this formation, for, besides forming the principal part of the various slates, shales, &c., it is almost every where infused and spread through them in great abundance, in the form of seams and veins. The color of these seams and veins is usually yellowish, white, or hyaline.

Gold Formation.—It has been known for a great number of years, that we have, in Vermont, a formation agreeing, in almost all respects, with the gold formation in the southern states, and in many other parts of the world; and it is a well known fact, that native gold was found here more than twenty-five years ago. The statement, which we published in a note on page 127, Part III., respecting a lump of gold picked up in Newfane, and weighing 8½ ounces, was extensively circulated in the newspapers soon after it was found. Our statement was derived from Gen. Martin Field, who had the lump in his possession. It was a fact well known to us, when our History and Gazetteer were published, that gold had been found in small quantities in the township of Somerset, by washing the alluvial gravel; but believing then, as we do now, that the success of Vermonters, in digging for gold, will be best secured by observing the Quaker's directions, *never to dig for it more than plough deep*, we took no pains to give prominence to these facts.

What we here call the Gold Formation constitutes a part of what we have been describing under the name of the Talcose Division. It forms a narrow and irregular belt, extending along near the eastern margin of the great division, above mentioned, and reaching through the entire length of the state. Beginning at the line of Massachusetts, in Whitingham, it extends northward, through the western part of Windham county, through Ludlow, Bridgewater and Rochester, in Windsor county; through Roxbury, Moretown and Waterbury, in Washington county, and thence through Morristown, Eden, Lowell and Troy, to the north line of the state. The rocks, which mark the line of this formation, are talcose slate, steatite and serpentine, accompanied by magnetic, specular, chromic and titaniferous iron, also sulphuret and hydrous peroxide of iron. At some places, beautiful specimens of rock crystal occur, many of which are traversed in various directions by hair-like crystals of rutile, rendering them exceedingly interesting to mineralogists. The fine specimens of this kind which have been found in the drift in the valley of the Connecticut, probably had their origin in this formation. Although, long since, aware of the fact that the formation, in which gold was found in Windham county, extended through the whole length of the state, we had no knowledge that gold existed in Vermont to the northward of that county, previous to the fall of 1852, when gold was discovered in Bridgewater, Windsor county, by a Mr. Kennedy, and the discovery made known to the public by Prof. O. P. Hubbard, of Dartmouth College. The gold is found there in seams of quartz, and also, in alluvial gravel. Sufficient time and opportunity for examination have not yet been had, since the discovery was made, to determine its value. Some specimens of the gold, which we have seen in the quartz, though small, were exceedingly fine and beautiful.

In the neighborhood of the gold in Bridgewater, very fine specimens of galena, or sulphuret of lead, are also found, but we are not informed with regard to its extent; but as Bridgewater is our native town, we hope ere long to have occular view of the revelations, which are being made there.

Although the formation, (in which gold is found) may be traced through the entire length of the state, it is not to be expected that gold will be found through its whole extent; nor is it, at present, at all certain that the *placers*, where gold has already been found, will yield gold enough to pay for working. This same gold formation, which passes through Vermont, has been traced from the north line of the state at Troy, nearly 200 miles into Canada. It passes along a little to the westward of Memphremagog lake to Orford, near Sherbrooke, and thence takes a more northeasterly course to the neighborhood of Quebec. Gold was found, in this formation, along the river Chaudiere, as early as 1834, and the discovery was announced in Silliman's Journal in April, 1835. From that time gold was collected there, in small quantities, up to the time of the discovery of gold in California; amounting in the whole to only a few hundred dollars. Since the geological survey of Canada has been in progress, more attention has been given to the subject, and it is found that the auriferous district is quite extensive. During the last three or four years the search for gold has been prosecuted more extensively, and the yield has amounted to several thousand dollars. In Ascot, near Sherbrooke, gold has been found in veins, associated with copper pyrites in a quartz gague; and it is reported that a lump of gold, weighing 14 oz., was obtained in that vicinity in the fall of 1852.

The steatite, or soapstone, and the serpentine, which we have mentioned, as indicating the line of the gold formation, are, probably, destined to be of quite as much economical value to the state, as the gold itself. The steatite is abundant, and is, in many places, of a very good quality. It has been quarried at Grafton, Bridgewater, Bethel, Moretown, Waterville, and, perhaps, a few other places. The serpentine is largely developed at Cavendish and Ludlow, at Roxbury, and at Lowell and Troy. Much of this serpentine is compact and firm, beautifully variegated with every shade of green, from the lightest tints to an almost perfect black; and, as it admits of a high polish, and is unaffected by heat and acids, it forms a most valuable ornamental marble. It has long been used, to a limited extent, in some of the neighborhoods where it is found, for fire-places, centre-tables, &c., and the opening of rail roads, through these several localities, will, probably, be the means of bringing this valuable marble extensively into use.

CALCARIO-MICA SLATE DIVISION.

Under this general name, we embrace all the territory of Vermont, not included in the divisions already described, with the exception of a few tracts of granite. It has been called the *calcario-mica slate* formation, or division, from the fact, that it consists, to a very considerable extent, of impure limestone, interstratified with argillaceous and mica slate. These three constitute the principal rocks, but they, in many parts, run into several other varieties of slate. Through the central part of Orleans county, and in Caledonia county, are extensive ranges of what might properly be called hornblende slate. In the northern part of Essex county, extending into Canada, is a range of siliceous slate; and in the southern part of that county there is a considerable development of chlorite slate.

The western portion of this formation, from Barnard northerly to lake Memphremagog, is mostly clay slate. This slate constitutes a large proportion of that beautiful and fertile swell of land extending from Winooski to White River, through the towns of Berlin, Williamstown, Brookfield and Randolph. It is also largely developed in the north part of Montpelier, and in Calais, Craftsbury and Coventry. At Berlin, this slate has been found to answer very well for roofing; and it is not improbable that good roofing slate will be obtained from some of the other localities, which we have mentioned.

Clay slate also exists, in large quantities, along the Passumpsic and the west bank of the Connecticut river, in the counties of Orange and Caledonia, and also in the southeastern part of Windham county. At the latter place, it extends through the towns of Guilford, Brattleborough and Dummerston. The slate here is found to be very suitable for roofing, and has been, more or less, quarried for that purpose for many years.

The mica slate of this division is not, in general, very well characterized as mica slate. Indeed, the slates, or shales, of this division, appear to be a combination, or jumble, of almost all the known varieties, sometimes exhibiting a predominance of one kind and sometimes of another; and, again, we find the materials of three or four different varieties combined in a single stratum. There are, however, some small tracts, to which the above remarks are not applicable. This is the case with some parts of Windham and Windsor counties, where mica slate is found, well characterized, and forming a valuable and beautiful material for flagging.

The limestone of this division is, every where, very impure, containing a very large proportion of siliceous sand. It is burned in several places for quicklime, but the lime is nowhere of a good quality. It is made to answer in mortar for stone work, where better is not to be had; and it is usefully applied, in agriculture, as a fertilizer, to soils deficient in lime. But the lime made from the beds of shell-marl, which abound in this division, though that is not of the best quality, is much preferable to the above, both for the purposes of masonry and agriculture.

The color of this limestone, where unaffected by the weather, is of a bluish shade, and the stone is very compact and homogenious, splitting, or breaking, with nearly equal facility, in all directions. Where long exposed to the weather, it is recognized at once by its rust-colored, rotten surface. This rotten surface consists of the siliceous sand, which remains after the lime, which had cemented it together, has been dissolved and washed out. In Hardwick, Berlin, and some other places, this blue silicious limestone is regularly arranged in parallel strata, showing very distinctly planes of deposit. But it more commonly occurs in irregular beds of unequal thickness, in the different varieties of slates.

Throughout nearly the whole of what we have called the *talcose* division of the state, the waters are soft and very pure, but those of the calcario-mica slate division are, on the contrary, hard, being, in general, strongly impregnated with lime. But the reason is obvious; for, in the former case, there is no lime, excepting what exists in the materials of the drift, while in the latter, besides the lime in the drift, the blue silicious limestone of the formation is diffused through every part, and being, by exposure, readily disintegrated and dissolved, keeps the waters of the neighborhood constantly impregnated with lime.

The principal metalic ores found in this division, are iron and copper *pyrites*, or the sulphurets of iron and copper. These, and particularly the sulphuret of iron, are found, though, for the most part, sparingly, throughout the whole division, usually in the form of small yellow cubes, which are not unfrequently mistaken for gold. The most extensive deposits of pyrites are at Strafford, Corinth, Woodbury and Brighton. That at Strafford is fully described, together with an account of the manufacture of copperas from it, in our description of that town in Part III., page 167. The veins of pyrites at Corinth consist of the sulphurets of copper and iron in nearly equal proportions. In Thetford there is a small vein of galena or sulphuret of lead.

In the different parts of this great division of the state, there is found a considerable variety of interesting minerals, most of which are mentioned in Part III., under the names of the towns in which they are found.

TERTIARY FORMATION.

It has been generally supposed, until within a very few years, that no geological formation existed in Vermont, of an age intermediate, between the lower silurian and the drift, or post-tertiary. In other words, it was supposed that the corboniferous series, and the secondary and tertiary formations, were entirely wanting. Still it has been long known that there was a series of deposits along the western foot of the Green Mountains, the geological age of which was extremely doubtful, and it was not till the discovery of the deposit of Brown Coal in Brandon, in 1848, that the uncertainty was in any degree removed.

The deposits above mentioned, commence in the south part of the state, at Bennington, and, extending northward, have been traced as far as Milton, in Chittenden county; and, probably, will be traced still further north into Canada. The material in these deposits, which first brought them into notice, was the brown oxide of iron, or brown hematite. This iron ore has been known and worked at Bennington, Pittsford, Brandon and Monkton, for a great number of years.

It was also early noticed that there were beds of a beautiful white clay, along the same line, generally in the vicinity of the brown iron ore. The nature of this clay was little understood, but being found to answer as a substitute for whiting, it was, for a while, considerably used in making putty for setting glass. Hence these beds of clay became known as *putty beds*. During the war with Great Britain, in 1812, one of these beds in Monkton was examined by Prof. J. Muzzy, who published an account of it, with an analysis of the clay, in the "Repository," a monthly periodical, published at Middlebury. He showed it to be *kaolin*, or porcelain clay; and efforts were made, about that time, to get up a manufactory of porcelain ware.

Subsequently, associated, for the most part, with the beds of brown hematite, were found, not only extensive beds of pure yellow ochre, but large quantities of the ores of manganese, both of which are articles of much economical value; and at some localities in the same connexion, were also found beds of very pure white quartz sand. The deposits, above mentioned, along the western foot of the Green Mountains, have been, as already remarked, known for many years. But in addition to these, in sinking shafts in the iron ore-bed, in Brandon, about 1848, a deposit of Lignite, or Brown Coal, was discovered, which has thrown some light upon the geological age of the deposits above described.

Of all the localities, to which we have referred, that at Brandon is the most interesting, not only on account of the Brown Coal, but on account of having all the other materials in conjunction with it. We have here, in the area of a few acres, the following substances, which are of economical value:

1. Pure white quartz sand.
2. Beautiful white and stained kaolin, or porcelain clay.
3. Yellow ochre.
4. Brown hematitic iron ore.
5. Ores of manganese.
6. Brown Coal.

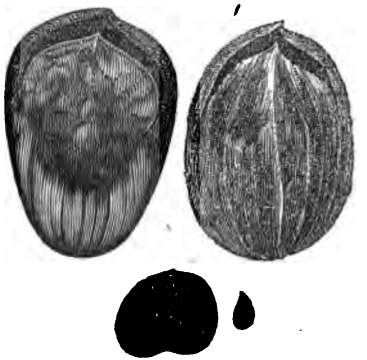
The two first, in the above list, make their appearance at, or very near, the surface;

and the coal may also be traced to the surface. But the great bulk of the clay, iron, manganese and coal, is buried at a considerable depth beneath the drift, which consists principally of pebbles, gravel and ochrey earth.

In the area above mentioned, there have been sunk, principally for obtaining the iron ore, five shafts, to depths varying from 100 to 130 feet. From these shafts, at depths of 80 or 90 feet, drifts have been sent off in various directions, connecting the different shafts, and various galleries have also been formed by the removal of the ore. By the shafts and drifts, the iron, clay and coal have been passed through in various directions, and something has been learned respecting their relative position and extent. The locality was visited during the summer of 1852, by a number of distinguished geologists, among whom were Dr. Hitchcock, President of Amherst College, Sir Charles Lyell, Prof. James Hall, of Albany, and Mr. Foster, United States Geologist; and the conclusion seems to be, that the formation, embracing the hematitic iron ore, the manganese, the kaolin and the coal, are of the same geological age, as the brown coal of Europe, and, therefore, belong to the tertiary period.

The extent of the brown coal at Brandon, is not yet ascertained. It shows itself at, or very near, the surface of the ground, and has been found at the depth of 90 feet. It seems to descend somewhat obliquely, by the side of the kaolin, in a columnar form, about twenty feet wide and fourteen feet thick. The carbonaceous materials are of a dark brown color, approaching to black. Some portions of them are very completely converted into coal, while, in other parts, the woody structure and the form of the trees are clearly seen. Scattered in this mass of materials, for the most part near the surface, are found many varieties of seeds or fruits, which vary in size from that of a fig to that of less than a barley-corn. These fruits were at first supposed to be butternuts, walnuts, chestnuts, hazelnuts, &c., such as are now indigeneous in Vermont, but a very slight examination suffices to show that they are unlike any vegetation now growing in our country.

President Hitchcock, in an interesting article* on the deposit of brown coal at Brandon, has figured about twenty species of the fruits found in it, and his figures, for the most part, agree very well with specimens of the fruit obtained by myself from the coal. To furnish some idea of these fruits, I give, in the next column, figures of a few of such of the fruits as I have in my possession.



The Brandon coal contains a considerable amount of earthy matter, but it burns readily, even when first taken from the bed; and is employed, almost exclusively, for fuel in driving the steam engine, by which the iron ore is raised and the water pumped from the mine.

As the hematitic iron ore, kaolin, manganese, &c., which occur at Brandon in conjunction with the coal, are found at numerous other places in Vermont, along the western foot of the Green Mountains, it is, also, highly probable that at some of these places, coal will likewise be found.

The conclusion to which President Hitchcock has arrived, from his examination of the subject, is, that the formation of which the Brandon deposit is a type, belongs to the tertiary period, and that it extends through the entire length of the United States, from Canada to Alabama.

IGNEOUS ROCKS.

The only unstratified igneous rocks in Vermont, which occupy any considerable extent of territory, are granite and serpentine. The fields of granite are nearly all included in the calcario-mica slate division of the state. The granite appears, every where, to have been forced up from beneath, in a melted state, between the strata and beds of slate and limestone, sometimes in small isolated elevations; but for the most part in long narrow ranges, extending north and south, in accordance with the strike of the outcrop of the strata. This is particularly observable in the eastern part of the counties of Orleans and Washington, and in the western part of Caledonia county.

The most extensive tracts of granite, and the only ones, which have much width from east to west, are in Essex county, and in the southwestern part of Caledonia county, and the adjacent parts of the counties of Washington and Orange. It was from the southwestern part of this last tract, in Barre, that the granite was obtained of which the State House was built. Further south, in the counties of Windsor and Windham, there are many isolated patches of granite and gneis, but with the exception of Ascutney mountain, they are of quite limited extent. In numerous places, granite is seen traversing the other rocks, in the form of dikes, veins and seams. This is particularly observable in Marshfield and Woodbury; and this fact, and, also, the fact that fragments of clay slate are there found, embedded in the granite, make it certain that the granite has been in a melted state since the formation of the slate.

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* Silliman's Journal of Science, Vol. XV.,—p. 95.

Granite boulders are scattered, more or less abundantly, over the whole of this division of the state. In the northeastern part, they are exceedingly numerous, and many of them are of very great magnitude. From a single granite boulder, in Greensborough, the material for a good sized stone house, including the walls of the cellar, were obtained, without using it all. Another isolated boulder in that town, is 41 feet long, 22 feet high, and, in the widest part, 25 feet wide, and is calculated to weigh more than a thousand tons. About half a mile from this large boulder, there are two smaller granite boulders, about 80 feet apart, so nicely balanced, on other granite rocks, as to be easily rocked by a push with the hand, and hence they have acquired the name of *the rocking stones.*

Rocking Stones.

The accompanying rude cut will serve to show their relative positions. They are both considerably elevated above the surrounding country. The one at the right hand in the figure is 9 feet high, 12 feet long, and weighs about 70 tons. It rests upon another mass of granite about 16 feet high. The other rocking stone, at the left, is 8 feet high and 11 long, weighing about 40 tons.

The granite of this division, though generally good, and, much of it, of a superior quality for building purposes, exhibits, nevertheless, several varieties. Perhaps the most remarkable of these, is that found in place in Craftsbury and Northfield, and which has, sometimes, been called *Nodular Granite.* The granite is of the ordinary character, with the exception of having flattened balls of black mica, about one inch in diameter, scattered through it, like plums in a pudding. These balls, or concretions, are composed of concentric layers of black mica, separated from each other by extremely thin layers of pure white quartz. In some portions of this granite the balls, or nodules, constitute quite one-half of the entire mass, while, in other portions, they are scattered very sparingly, often several inches asunder, in all directions. The only locality, beside those just mentioned, where this granite is found in place, is just over the north line of Vermont, in Stanstead, C. E. Boulders of it are scattered, sparingly, over a great part of the surface of the counties of Orleans and Caledonia.

The *serpentine* has been already mentioned in our account of the talcose division, as occurring along the line of the gold formation. Some of those tracts are quite extensive, forming hills of considerable elevation. This is the case in Cavendish, Lowell and Troy. In the serpentine in Lowell, fine specimens of asbestus and of different varieties of amianthus, are common. In Troy, it contains a large irregular bed or vein of iron ore. The ore appears well, and extensive works were erected for manufacturing it into iron; but the difficulty of working it, on account of the titanic acid it contains, and the cost of transportation, rendered the business unprofitable, and the works were, therefore, abandoned and have gone to decay. The following is the result of the analysis of this titaniferous iron ore, by Mr. Olmsted:

Peroxide of iron, - - - -	81.20
Protoxide " - - - - -	13.37
Titanic acid, - - - - -	4.10
Silica, - - - - - - - - -	1.33
	100.00
Metalic iron, - - - - -	66.62

Chromic iron is also met with in many places in the serpentine of this neighborhood. In Jay, there are veins of it two feet wide. The ore is of good quality, and might easily be obtained to any amount. Its analysis, by Mr. Hunt, gave the following result:

Green oxide of chromium, - -	49.90
Protoxide of iron, - - - - -	48.96
Alumina, with traces of silica, &c.,	1.14
	100.00

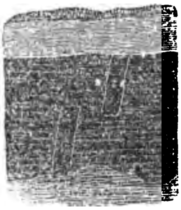
One hundred parts of this ore will yield 191 parts of chromate of lead, or chrome yellow.

TRAP AND PORPHYRY.

These are found in Vermont only in the form of dikes, or intrusive beds among the other rocks. Trap dikes are met with in all parts of the state, but they are much more common in some parts than in others.

In the central part of the state, in the talcose slate formation, they are exceedingly rare. They are more common in the eastern part of the state; but abound most of all in the vicinity of Lake Champlain, and, particularly, in the neighborhood of Burlington.

The strike of the various stratified rocks in Vermont is, generally, from a little west of south to a little east of north, while the trap dikes, for the most part, cut through these rocks in a direction nearly east and west. The width of these dikes varies from three or four inches to five or six feet. The width of the greater part differs but little from three feet. They sometimes cut through the rocks quite obliquely, both to the strike and the horizon, but are more commonly nearly perpendicular to both. In some cases, the same dike may be traced for several miles, in nearly a straight line, across the outcrop of the strata. In other cases they will terminate suddenly, and commence anew, at some little distance to the right or left, and then proceed onward in the same direction as before. Faults of this kind are of frequent occurrence in the numerous trap dikes, which exist in the black shales along the eastern shore of Lake Champlain. The accompanying cut represents one of these, as seen in the bank of the lake at Clay Point, in Colchester.



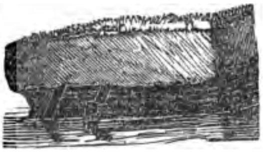
Trap Dike.

The fault is an offset of about three feet. The dike is in black slate. The part of the bank above it is sand. At Hubbell's Fall, in Winooski-river, two faults may be seen, in the same dike, in the bottom of the river.

Some of these dikes are very compact and homogenious. Some have a concretionary structure, and, by exposure to the weather, separate into spheroidal masses. Others again exhibit signs of a columnar structure; and still others contain numerous light colored crystals, giving it an amygdaloidal character. An interesting dike of this character may be seen in a small island in Lake Champlain, a little to the northward of Colchester point.

The Porphyry Dikes are mostly confined to the southwestern part of Chittenden county. Like the trap dikes, they have, in general, an easterly and westerly course, but they are much more irregular in their direction, and much less uniform in width. In some places they seem to bilge up in large rounded masses, crowding and crushing the slate all around. The color of these dikes and intrusive masses, varies from a dark chocolate brown to a light cream color. In some cases, the embedded crystals are very numerous; in others, they are rare; and in others still, no crystals are seen, but they appear to consist of a homogeneous mass of feldspathic mineral.

No part of the state, which has been examined, so much abounds in dikes, both trap and feldspathic, as the northwestern part of Shelburne. Pottier's point is crossed by a dozen, at least. At Nash's point, the two kinds of dike are seen together, in circumstances to afford a clear indication of their relative ages. Their positions may be understood by the accompanying cut.



Porphyry Dikes.

The cut, which represents the western side of the point, exhibits a perpendicular face of porphyry, about 11 feet high and some rods in length, resting upon black slate, and covered above by about 2 ft. of black slate and soil. Cutting through the slate, in an easterly direction, beneath the porphyry, are two parallel trap dikes, about eight feet apart, and each about one foot wide. Portions of these trap dikes are also found in the slate overlying the porphyry. These facts make it certain that the trap dikes existed in the slate before the porphyry was thrown up, and that they were broken off, and parts of them lifted up with the slate by the intrusion of the porphyry. The more recent origin of the porphyry is also inferred from the fact that it is frequently found to have flowed laterally between the strata of the rocks, while the trap is never found to have done so, showing that the latter was formed under a much greater incumbent pressure than the former. Trap has been no where found in Vermont in the condition of an overlying mass.

The only purely igneous rock, observed any where in Vermont, on the west side of the mountains, in any other form than that of dikes, is in Charlotte. It there forms the hill, south of the Four Corners, and presents a surface of a number of acres. It is, in appearance, intermediate between common trap and porphyry, and most of it is exceedingly hard. The position of this hill may be seen on the map of Charlotte, given on page 19, it being the hill indicated on the map nearest the locality of the fossil whale.

SUPERFICIAL DEPOSITS.

Drift Scratches.

The rocks which have been briefly described, with the exception of our tertiary formation, are all fixed in the places in which they are found, and form the solid foundation of our territory. The surface of these rocks, where exposed to view, are every where found to be ground, or worn down by some agency, frequently having their surfaces finely polished, and crossed by numerous parallel striæ, or scratches. These striæ, or scratches, lying in the same direction, in which the loose materials, resting upon the solid rocks, have been transported, are supposed to have been produced by the movement of these materials; and, as the materials have received the name of Drift, the striæ, or grooves, are called *Drift Scratches*. The general direction of these scratches, and of the transportation of drift materials, is towards a point a little to the east of south, but varies in different parts of the state, somewhat in conformity to the directions of the valleys and the ranges of mountains.

The smoothing and striation of the surfaces of the rocks are most conspicuous, when the earthy materials are first removed from them. In some varieties of rocks they are seen, in a great measure obliterated by exposure to the weather. These polished and striated surfaces are found, not only in the bottoms of the lowest valleys, but upon the tops of the highest mountains in the state. Mount Washington, in New Hampshire, appears to be the only point in New England, which was not reached by the agency which produced them. The rocks, which form the summit of that mountain, are all sharply angular, exhibiting no appearance of having been worn, or scratched.

Drift Materials.—The smoothed and striated solid rocks, which we have been describing, are, in nearly all parts of the state, covered by a deposit, very variable in thickness, and consisting of boulders, pebbles, gravel, sand and clay, variously and irregularly blended together, without any distinct signs of stratification. These materials are, for the most part, different from the rocks on which they rest; and, as they are usually accompanied by evidence that they have been transported in a southeasterly direction, they have received the general name of *Drift*. In some places the drift consists entirely of sand; in other, of clay; in others, of gravel; but these are usually of small extent. The materials are more commonly mixed, but in very different proportions in different places. It is quite common to find them in the condition of what is called *hard-pan*, wherein sand, clay, gravel and pebble are so completely bedded together as to make it extremely difficult to penetrate them.

The proofs that the drift has been transported in a southerly direction, and never in a northerly direction, are very abundant. The large boulders of sienite and other rocks scattered through the valley of Lake Champlain, have evidently been brought from beyond the 45th parallel of latitude, there being no rocks of their kinds within the limits of the state. Boulders of Trenton and Isle la Motte limestone are found scattered along the western slope of the Green Mountains, and resting on talcose slate, far to the southeastward of the quarries from which they must have been derived. Boulders of the red sandrock, which is found in place only near the lake shore, are met with in masses, of several tons, in Williston and Richmond, and high up on the sides of the mountains, and even to the eastward of these mountains. To the eastward of Camel's Hump, in Duxbury, there is a boulder, which weighs about three tons, and which very clearly came from the lower strata of the red sandrock formation, near the level of Lake Champlain. It is now 20 miles from the nearest part of that formation, and rests upon talcose slate, at an elevation of about 700 feet above the level of the lake.

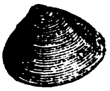
The transportation of boulders of what we have called Nodular Granite, has already been mentioned. They are found, of large size, in Waterford, Ryegate, and other places, 30 miles from any locality, where the rock is in place, Instances might be mentioned, where boulders of this rock have been transported over deep vallies, and lodged near the summit of the elevation on the opposite side.

LAWRENCIAN DEPOSIT.

Throughout the valley of the St. Lawrence, the valley of Lake Champlain, and around Lake Ontario up to the Falls of Niagara, there is found a regularly stratified formation of sands and clays, to which has been given the name of the *Lawrencian Deposit*. The thickest parts of this formation, in the valley of Lake Champlain, is about 200 feet, and the highest part of it is, at least, 400 feet above the level of the ocean. The southern portion of it consists chiefly of clay, while in Franklin county and the northern part of Chittenden county, sand predominates, particularly at the surface.

It is clearly a marine deposit, being well filled with remains of marine bivalve molluscs and other animals ; and, as nearly, or quite, all of these remains belong to existing species, it is plain that it belongs to a very recent geological period, or is what is called a Pleistocene, or post tertiary formation. These remains are mostly shells of molluscs, with a few remains of whales, seals and fishes; and they are nearly all identical in species with those living on the coast of New England, and in the Gulf of St. Lawrence.

Nearly an entire skeleton of a whale was found in this formation, in Charlotte, as mentioned on page 15. A number of the lumbar and caudal vertebræ of a whale, probably of the same species, have also been found in a similar clay bed, on the Island of Montreal, as already stated in a note on page 20. The species of fossil shells, found in this formation, are quite numerous, but the most common in the Champlain valley are the following:



Sanguinolaria fusca.—This is the most common and abundant species. It is met with, in hundreds of places, along the banks of the lake and streams, in digging wells, in making excavations for roads and railroads, and in cultivating the lands. It is met with at the distance of several miles from the lake, and often more than 200 feet above it.

Saxicava rugosa.—This species is quite common, but is not so generally diffused as the preceding. The shell, being thick and strong, is often found in a very good state of preservation.

Mya arenaria.—This is the largest of the fossil shells found here. There are fewer localities of this than of the two preceding species, but at some of these the individuals are so multiplied as to be exceedingly numerous; and they are often well preserved.

Nucula portlandica.—This shell is found low in the blue clay, but is not abundant.

Mytilus edulis has been found only at a few localities; but in some cases the individuals are quite numerous. They are seldom well preserved.

The *Sanguinolaria fusca* is a littoral mollusc, which lives and propagates only in the sweep of the tide. This fact throws light upon the progress of subsidence of the St. Lawrence and Champlain vallies, by which the ocean, (from which the Lawrencian deposit took place,) was admitted into them. In various strata we have this mollusc embedded in the position in which it buries itself, when alive, and where it had evidently propagated, with the two valves united, and the epidermis undisturbed. These strata must, therefore, have been at the surface of the ocean, when the animals were buried. But we find them thus bedded in strata more than 60 feet apart, in vertical height, showing clearly that the subsidence was a very gradual one.

Fossil Sponge.—While digging a well in Alburgh, about four years ago, at the depth of 11 feet, the workmen came upon a horizontal stratum of what appeared to be mats of hair. It was in quite compact clay, was about two inches thick, and extended over nearly the whole bottom of the excavation. It excited much curiosity, but very little of it was saved. Having obtained a small quantity of it, I sent it in a letter to my friend, Prof. J. D. Dana, who pronounced it, both upon his own authority and that of Prof. Bailey, of West Point, to be *Fossil Marine Sponge.*

Fossil Wood.—It is not uncommon, in the vicinity of Lake Champlain, to find wood, and other vegetable matter, buried at various depths in the earth, in places and under circumstances, in which we should little expect it. There have been several cases of this kind in the village of Burlington, which I shall here mention, and all of which, with one exception, have fallen under my own observation; and that one is well attested.

The first of these cases was in 1835. That year the Hon. Alvan Foote, who resides, about 40 rods, directly north of the University, dug a well near his residence. The surface of the ground, at the place, was originally covered with a heavy growth of timber, and large boulders were thickly scattered over it. In digging the well, the first four feet were loose earth and gravel. The next 20 feet were what is commonly called *hardpan*, consisting of pebbles, gravel, sand and clay, very solidly compacted together. Next came a sandy earth, which could be shoveled without being loosened with a pickaxe, for about 4 feet, when the workmen, to their astonishment, broke into a hollow cavity, extending across the bottom of the well.

Upon examination, the cavity was found to have been occupied by a large tree, supposed to be pine, parts of which were remaining, and quite sound. It had been embraced by the sand; but, a few inches lower down, a stratum of black carbonaceous matter was found, resembling muck. The natural surface of the ground, where the well was dug, was about 240 feet above Lake Champlain, and the tree was 29½ feet below the surface of the ground.

The next case was in 1850. In making the excavation, on Pearl street, for the reservoir, connected with the aqueduct, which supplies the lower part of Burlington with water, at the depth of 13 feet from the surface of the ground, a large amount of wood, sticks and leaves were found embedded in clean gravel. The locality is about 200 feet above the lake, and the size of the excavation was 36 feet by 40. The surface of the ground sloped moderately towards the northwest, and was originally covered heavily with timber. The earth, after getting below the soil, was sand and gravel, which had been washed and assorted by water, and was lying in irregular beds, sloping steeply towards the northwest. The vegetable remains formed a mass in the gravel about two feet wide, one and a half foot deep, and 36 feet long, extending in a right line, and was, at first, mistaken for a rotten tree; but, on breaking it to pieces, it was found to consist of roots, limbs, bark, stems and leaves, snugly bedded together, and all of a dark brown color; some portions of it approaching, in appearance, to brown coal. Many of the sticks and roots were perfectly sound, and exhibited the structure of the wood completely, and are, I have little doubt, the American Larch, *Pinus peudula*.

In October, in laying the aqueduct pipes in the south part of the village, wood, resembling larch and oak, were found, at the depth of 10 feet beneath hardpan. And in April, 1852, in deepening the well at the Pearl Street House, which is midway between the two localities first mentioned, a piece of wood, ten inches long, six wide and three thick, was found below hardpan, 24 feet from the surface. The Pearl Street House is about 230 feet above the lake. Wood has also been found in the central part of the village, in the stratified sand and clay, 20 feet below the surface.

The question now arises—to what geological period does this fossil wood belong? The last mentioned certainly belongs to the post tertiary or Lawrencian, for the characteristic shells were found with it. In the other cases, the earth was unstratified, and the materials, which covered the wood, evidently belonged to the drift. But did the wood belong to the drift period?—or to the tertiary which preceded it?

To these last questions, I would answer, that, in my opinion, it belonged to neither. The wood, and materials associated with it, are totally unlike the lignite, and its associates, which constitute the tertiary at Brandon, and no one can for a moment regard them as belonging to the same period. But the wood is beneath or within, what are, evidently, drift materials. How can this be, unless the wood and drift are of the same age?

To answer this question, we are to consider that the elevation on which the University stands, was, at the close of the drift period, a high ridge of drift deposit, having a steep descent towards the northeast and northwest. Subsequently the whole Champlain valley subsided, the sea was let in, and this elevated ridge became more and more immersed, and the materials forming its steep declivities were gradually washed down and re-arranged by the action of the waves.

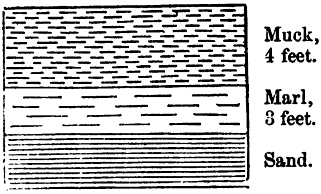
Previous to the burial of the tree first mentioned, there appears to have been a small marsh at the foot of the steep bank of drift. When the subsidence had let the sea in upon this marsh, the tree was floated in and lodged at the foot of the bank. The subsidence continued, and the action of the waves soon washed down the drift materials and covered the tree; and we have evidence that the valley continued to sink till the whole ridge was immersed, and the island disappeared. During this immersion, the materials continued to be washed down, and beaten and pressed together by the surf and weight of the water, until the wood became buried in the condition in which it is found, since the sea was emptied out by the upheaval of the valley; so that while the wood is buried in the drift, it has been buried by a re-arrangement of the drift materials, since the drift period.

SHELL MARL.

The beds of shell marl in Vermont are considerably numerous, and some of the beds are quite extensive; but they are entirely confined to what we have called the calcario-mica slate division, on the east side of the Green Mountains, and to a small portion of the western border of the state. On that large central portion of the state, which we have called the talcose slate division, not a single marl-bed is known to exist. The marl, which constitutes these beds, has a general resemblance to pulverised chalk, and consists, essentially, of carbonate of lime, which has resulted from the partial decay and crumbling of innumerable fresh-water shells, with sometimes a slight intermixture of sand and clay. Though, when wet, like a bed of putty, and when dry, a pulverulent mass, still shells, more or less entire, are found to be scattered through all parts of it: and near the surface unbroken shells are often numerous.

These shells are, for the most part, of the same species, which are now found living in the ponds and streams of the neighborhood, and belong chiefly to the following genera, viz: Paludina, Limnæ, Physa, Planorbis, Pupa and Cyclas.

Marl beds exist in all the counties on the east side of the mountains, but are most numerous in Caledonia county. There are several in each of the towns of Barnet, Peacham and Danville. In Orleans county, and in the eastern part of Washington county, there are a few. The following section exhibits the thickness and association of one of these marl beds in Derby, with its overlying muck and underlying sand:



Muck and Marl Bed.

The most valuable bed of marl known on the east side of the mountains, is in Williamstown. It is from 6 to 18 feet deep, and slightly covered with a dry soil. It is very pure carbonate of lime, and makes the best quicklime obtained in that part of the state. Its analysis, by Mr. Hunt, gives the following results:

Carbonate of Lime, - - - -	89.
Carbonate of Magnesia, - - - -	4.2
Silica, with traces of oxide of iron and alumina, - - - - - -	1.
Water and organic matter. - - -	5.5=99.7.

The marl beds on the west side of the mountains are not numerous, but some of them are quite extensive. The most interesting beds are those in Monkton and Alburgh. That at Alburgh extends over 60 acres. Where examined, it was found to be from 6 to 9 feet deep, resting on fine blue clay, and covered by vegetable muck to the depth of five feet, upon which there had been a large growth of forest trees. Supposing the average depth of the marl to be only three feet, the aggregate amount would exceed 60,000 cords, and the muck resting upon it would probably exceed 100,000 cords.

An account of the marl in Monkton pond, and of the manner in which these marl-beds are formed, may be found in Prof. Adams' Second Annual Report on the Geology of Vermont, page 148.

Shell marl is valuable, both for the manufacture of quicklime, and as a fertilizer to be applied to the soil. To obtain good quicklime from it, it should be moistened, made into the form of bricks, and, after being dried, should be arranged and burned in kilns, for the expulsion of the carbonic acid, by fires placed beneath, as is done in the manufacture of common bricks. This is the course pursued at Williamstown, where our best marl lime is made.

The value of marl, as a fertilizer, depends upon the constituents of the soil to which it is applied. If the soil is already sufficiently supplied with lime, for the purposes of vegetation, the application of marl will produce no sensible effect; and this is generally found to be the condition of the soil in those neighborhoods in which marl-beds are found. Indeed, the connexion between the marl and the lime, in the soil and waters of the vicinity, is very obvious; for the pre-existence of the latter, is absolutely necessary, for the existence and multiplication of the molluscs, whose shells form the marl. If the lime did not exist in the water, there would be no material for the formation of the shells, and, therefore, the animals could not exist. Hence we learn the reason why there are no marl-beds on the talcose slate division of the state. There are, there, no limerocks, and only a very minute amount of lime in the soil and water, and hence there are hardly any land, or fresh-water shells. The soil, throughout the whole of that division, would undoubtedly be improved by the application of marl. The soil in the calcario-mica slate division, is, in general, well supplied with lime, by the decomposition of the blue siliceous limestone; and, in the western part of the state, by the marine fossil shells contained in it, and by the decomposition of the different limestones, which abound; excepting the sandy plains. These, though resting upon limestone, are very deficient in lime, and are greatly benefitted by the application of marl.

VEGETABLE MUCK.

In all parts of the state are found deposits of muck, consisting of partially decomposed leaves and other vegetable matter. These deposits vary in extent from a few square rods to many acres, and are from a few inches to 15 and 20 feet in depth. When the country was new, most of these were bogs, many of which have since become dry, either by draining, or by exposure to the sun and winds, in consequence of the removal of the forests. They are, not unfrequently, found resting on beds of marl, as has been already mentioned.

The cavities, in which these beds, both of muck and marl, are found, were, undoubtedly, originally, little pools or ponds of water, which gradually became filled up with the shells of successive generations of molluscs, and vegetable matter, thus diminishing the size of the pond by surrounding it with a bog, or, what was more commonly the case, filling it entirely, leaving only a bog in its place.

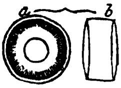
This muck is a valuable manure for most soils, and nature has provided plentiful stores of it, in almost every part of the state. Some of our farmers have already learned its use, as a fertilizer, and profited by its application; and we trust that it will soon be more generally appreciated, and more extensively used. The value, both of the muck and marl, for the improvement of some soils, is thought to be much enhanced by applying them in conjunction.

INFUSORIAL SILICA.

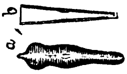
Several deposits are met with in different parts of the state, which, in their situation and appearance, very much resemble shell-marl, but instead of being, like that substance, calcareous, are a fine siliceous earth. By examination, under the microscope, this earth is found to have originated from the flinty shell of infusorial animalcules, in the same manner that the marl was formed from the calcareous shells of molluscs, and hence it received the name of *Infusorial Silica.*

The most extensive deposit of infusorial silica, known in the state, is in Hosmer's pond, in the southwestern corner of Peacham. This pond is surrounded by granite hills, and covers about 250 acres. The infusorial deposit is thought to average about six inches in depth, over the bottom of about two-thirds of the pond. When taken out and dried in lumps, it is a very good substitute for chalk. When dried and pulverised, it resembles calcined magnesia; and, hence, the pond is called, sometimes *Chalk* pond, and sometimes *Magnesia* pond. There is another small deposit of infusorial silica, in Maidstone, in Essex county.

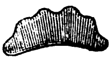
By the examination of specimens of the silica, from these deposits, by Prof. Bailey, of West Point, the shields of more than twenty distinct species of animalcules, were discovered in it. Some of these are so exceedingly minute, that, incredible as it may seem, it would require a million of them to make the bulk of a single mustard seed. By the labors of Ehrenberg, and others, these microscopic fossils have all been arranged, described and figured, so far as known, and many of the forms are exceedingly beautiful. I give, below, the figures of a few of the many species found in Hosmer's pond. Their areas are magnified in the cuts, about 73,000 times.



Gaillionella distans.



Gomphonema acuminatum.



Eunotia tetradon.

CLAY STONES.

Concretions of various kinds are found in Vermont, but the most common are those found in beds of clay, and generally known by the name of *Clay Stones.* These clay stones exhibit an almost infinite variety of forms. Many of them appear as if skilfully turned in a lathe, or beautifully carved by art; and hence they are every where regarded as objects of curiosity. Their most common form is that of a convex lens, or flattened sphere; but various forms are often blended together, in the most grotesque and fanciful manner. At some localities, they are found in the form of a perfect ring, like the ring of an ox-yoke, both in form and size. Those concretions, which abound in the Lawrencian formation, in the neighborhood of Lake Champlain, are generally cylindrical, having their longer axis nearly perpendicular to the stratification of the clay, and prolonged through several of the strata. These cylindrical concretions are all formed of concentric layers around the axis of the cylinder, which axis is a capillary opening, extending through its whole length. They appear as if they had been formed around fibrous roots, which had afterwards decayed out, leaving a small perforation, like a pith, extending through their whole length.* Localities of clay stones and other interesting concretions exist in various parts of the state, and are too numerous to be particularized.

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* Having an opportunity, in 1851, to examine the Crag formations in the east part of England, I satisfied myself that the, so called, coprolites, which abound there, and are so highly prized and extensively used as a fertilizer, are, for the most part, at least, concretions formed in the same manner as those above named. They differ in the materials of which they are composed, but do not, apparently, differ in the manner, in which they are formed While ours contain carbonate of lime, those found in the Crag, in England, are said to consist of 65 per cent. of the phosphate of lime, and hence the great value of the latter as a fertilizer. The clay in which those concretions were found, had probably abounded in fossil bones, and the decomposition of these bones furnished the lime, in the condition of a phosphate, for the formation of the concretions. Thousands of tons of these concretions are said to be, annually, separated from the Crag, and used as a manure.

POPULATION OF VERMONT.

There have now been seven complete enumerations of the inhabitants of Vermont, since the organization of her government. The result of six of these are given, by towns, in Part II., page 209. The result of the seventh is given below.

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POPULATION OF VERMONT IN 1850.

Towns.	Pop	Towns.	Pop.	Towns.	Pop.	Towns.	Pop.
Addison,	1279	Andover,	725	Averill,	7	Bakersfield,	1523
Albany,	1052	Arlington,	1084	Avery's Gr., F.C.	48	Baltimore,	124
Alburgh,	1568	Athens,	359	Buell's Gore,	18	Barnard,	1647

POPULATION OF VERMONT— SEVENTH CENSUS.

Towns.	Pop.	Towns.	Pop.	Towns.	Pop.	Towns.	Pop.
Barnet,	2521	Fairlee,	575	Montgomery,	1001	South Hero,	705
Barre,	1845	Fayston,	684	Montpelier,	2310	Springfield,	2762
Barton,	987	Ferdinand,	0	" East,	1447	Stamford,	833
Belvidere,	256	Ferrisburgh,	2075	Moretown,	1335	Starksborough,	1400
Bennington,	3923	Fletcher,	1084	Morgan,	486	Sterling,	233
Benson,	1305	Franklin,	1646	Morristown,	1441	Stockbridge,	1327
Berkshire,	1955	Georgia,	2686	Mt. Holly,	1534	Stow,	1771
Berlin,	1507	Glastenbury,	52	Mt. Tabor,	308	Strafford,	1540
Bethel,	1730	Glover,	1137	Newark,	434	Stratton,	286
Bloomfield,	244	Goshen,	486	Newbury,	2984	Sudbury,	794
Bolton,	602	Goshen Gore, nor.	183	Newfane,	1304	Sunderland,	479
Bradford,	1723	" " south,	32	Newhaven,	1663	Sutton,	1001
Bradleyvale,	107	Grafton,	1241	Newport,	748	Swanton,	2824
Braintree,	1228	Granby,	127	Northfield,	2922	Thetford,	2016
Brandon,	2835	Grand Isle,	666	North Hero,	730	Tinmouth,	717
Brattleborough,	3816	Granville,	603	Norton,	0	Tapsham,	1668
Bridgewater,	1311	Greensborough,	1008	Norwich,	1978	Townsend,	1354
Bridport,	1393	Groton,	895	Orange,	1007	Troy,	1008
Brighton,	193	Guildhall,	501	Orwell,	1470	Tunbridge,	1786
Bristol,	1344	Guilford,	1389	Panton,	559	Underhill,	1599
Brookfield,	1672	Halifax,	1133	Pawlet,	1843	Vergennes,	1378
Brookline,	285	Hancock,	430	Peacham,	1377	Vernon,	821
Brownington,	613	Hardwick,	1402	Peru,	567	Vershire,	1071
Brunswick,	119	Harris' Gore,	8	Pittsfield,	512	Victory,	168
Burke,	1103	Hartford,	2159	Pittsford,	2026	Waitsfield,	1021
Burling- (vil. 6110) ton, (town, 1475).	7585	Hartland,	2063	Plainfield,	808	Walden,	910
		Highgate,	2653	Plymouth,	1226	Wallingford,	1688
Cabot,	1356	Hinesburgh	1834	Pomfret,	1546	Waltham,	270
Calais,	1410	Holland,	669	Poultney,	2329	Wardsborough,	1125
Cambridge,	1849	Hubbardton,	701	Pownal,	1742	Warren,	962
Canaan,	471	Huntington,	885	Putney,	1425	Washington,	1348
Castleton,	3016	Hydepark,	1107	Randolph,	2666	Waterbury,	2352
Cavendish,	1576	Ira,	400	Reading,	1171	Waterford,	1412
Charleston,	1008	Irasburgh,	1034	Readsborough,	857	Waterville,	753
Charlotte,	1634	Isle la Motte,	476	Richford,	1074	Weathersfield.	1851
Chelsea,	1958	Jamaica,	1606	Richmond,	1453	Wells,	804
Chester,	2185	Jay,	371	Ripton,	567	Wenlock,	26
Chittenden,	675	Jericho,	1837	Rochester,	1493	West Fairlee,	696
Clarendon,	1477	Johnson,	1381	Rockingham,	2837	Westfield,	502
Colchester,	2575	Kirby,	509	Roxbury,	967	Westford,	1458
Concord,	1153	Landgrove,	337	Royalton,	1850	Westhaven,	718
Corinth,	1906	Leicester,	596	Rupert,	1101	Westminster,	1721
Cornwall,	1155	Lemington,	187	Rutland,	3715	Westmore,	152
Coventry,	867	Lewis,	0	Ryegate,	1606	Weston,	950
Craftsbury,	1223	Lincoln,	1057	St. Albans,	3567	West Windsor,	1002
Danby,	1535	Londonderry,	1274	St. George,	127	Weybridge,	804
Danville,	2577	Lowell,	637	St. Johnsbury,	2758	Wheelock,	855
Derby,	1750	Ludlow,	1619	Salem,	455	Whiting,	629
Dorset,	1700	Lunenburgh,	1123	Salisbury,	1027	Whitingham,	1380
Dover,	709	Lyndon,	1752	Sandgate,	850	Williamstown,	1452
Dummerston,	1645	Maidstone,	237	Searsburgh,	201	Williston,	1669
Duxbury,	845	Manchester,	1782	Shaftsbury,	1896	Wilmington,	1372
East Haven,	94	Marlborough,	896	Sharon,	1240	Windham,	763
Eden,	668	Marshfield,	1102	Sheffield,	797	Windsor,	1928
Elmore,	504	Mendon,	504	Shelburne,	1257	Winhall,	762
Enosburgh,	2009	Middlebury,	3517	Sheldon,	1814	Wolcott,	909
Essex,	2052	Middlesex,	1365	Sherburne,	578	Woodbury,	1070
Fairfax,	2111	Middletown,	875	Shoreham,	1601	Woodford,	423
Fairfield,	2591	Milton,	2451	Shrewsbury,	1268	Woodstock,	3041
Fair Haven,	902	Monkton,	1246	Somerset,	321	Worcester,	702

NOTE.—Montpelier and Windsor have each been divided into two towns, since the sixth census, and the town of Mansfield has been swallowed up by annexation to Stow. All these changes were made at the session of the legislature, in 1848.

Population by Counties.

Counties.	Population.
Addison, - - - - - - - -	26,549
Bennington, - - - - - - -	18,589
Caledonia, - - - - - - - -	23,595
Chittenden, - - - - - - -	29,036
Essex, - - - - - - - - - -	4,650
Franklin, - - - - - - - -	28,586
Grand Isle, - - - - - - -	4,145
Lamoille, - - - - - - - -	10,872
Orange, - - - - - - - -	27,296
Orleans, - - - - - - - -	15,707
Rutland, - - - - - - - -	33,059
Washington, - - - - - - -	24,654
Windham, - - - - - - - -	29,062
Windsor, - - - - - - - -	38,504
Total aggregate, - - -	314,304
White Males, - - - - - - -	159,748
White Females, - - - -	153,838
Total Whites, - - - - - -	313'586
Colored Males, - - - - -	375
Colored Females, - - - -	343
Total Colored, - - - -	718
Total aggregate, as before,	314,304

LITERARY INSTITUTIONS.

	No.	Teachers.	Pupils.
Colleges, - - -	5*	30	464
Public Schools, -	2789	4,204	94,795
Academies and Private Schools, -	95	272	6,231

LIBRARIES.

Public, (including School)	77	43,705
Private, - - - - -	133	55,773

NOTE.—In most of the counties no private libraries were reported which contained less than 1,000 volumes.

NEWSPAPERS.

Whole No. 36. Whig, 14 ; Democratic, 7 ; Literary, &c., 15.

	No.	Circulation.	Ann. Issues.
Daily, - -	2	550	171,050
Semi-Weekly,	1	2,200	228,800
Weekly, -	31	41,206	2,142,712
Monthly, -	2	2,000	24,000
	36		2,566,562

* Two of them Medical Colleges.

PRODUCTIONS OF AGRICULTURE IN VERMONT,—SEVENTH CENSUS—1850.

COUNTIES.	Acres of Land in Farms.		Cash Value of Farms.	Value of Farm Implements.	Horses.	Asses and Mules.	Milk Cows.	Working Oxen.	Other Cattle.	Sheep.	Swine.	Value of Live Stock.
	Improved.	Unimproved.										
Addison, - - -	243,812	115,287	$7,799,257	$256,270	5,921	1	10,691	2,815	13,248	188,154	5,822	$1,289,608
Bennington, - -	138,065	85,760	3,338,756	131,194	3,344		6,667	1,983	7,402	71,294	5,162	662,281
Caledonia, - - -	210,474	151.607	4,751,609	819,559	5,705	11	11,914	4,402	12,529	30,252	2,864	1,027,836
Chittenden, - -	177,707	104,454	5,624,439	217,843	4,897	17	12,790	2,324	9,859	57,184	6,492	898,732
Essex, - - - -	42,993	52,310	767,185	61,096	1,025		2,549	1,260	3,443	7,519	822	215,870
Franklin, - - -	180,848	127,002	4,284,070	215,418	5,396	94	16,217	3,307	14,890	58,509	5,418	942,262
Grand Isle, - -	33,171	15,113	1,189,682	38,993	1,300		1,856	238	1,465	18,949	937	122,588
Lamoille, - - -	76,083	76,070	1,851,471	107,505	2,032	39	5,511	2,225	6,124	15,193	2,476	422,671
Orange, - - - -	226,257	120,142	4,807,788	279,641	5,580	5	10,777	5,138	13,564	71,551	7,337	974,258
Orleans, - - -	119,377	127,520	2,492,090	150,114	3,724	6	8,101	3,631	9,592	27,422	3,825	645,412
Rutland, - - -	290,392	154,524	7,972,180	255,240	6,151		17,151	3,590	12,673	186,319	5,034	1,543,936
Washington, - -	165,654	120,289	3,965,385	165,179	4,140	15	11,507	3,922	11,190	32,355	5,507	878,766
Windham, - - -	319,558	99,674	6,301,500	248,874	5,054	1	13,979	6,081	17,744	58,553	6,005	1,223,724
Windsor, - - -	377,523	174,711	8,221,815	292,856	6,788	29	16,918	7,661	20,420	190,868	8,600	1,800,789
Total, - - -	2,601,409	1,524,418	$63,367,227	$2,789,282	61,057	218	146,128	48,577	154,148	1,014,122	66,296	$12,643,228

NOTE.—By comparing the numbers in the above table with the returns of 1840, given in Part I., p. 52–57, it will be seen that, while the number of horses and cattle has remained nearly the same, there has been a very great diminution of the number of hogs and sheep. The number of sheep returned shows a diminution of more than 600,000.

PRODUCE OF THE YEAR ENDING JUNE 1, 1850.

COUNTIES.	Wheat, Bushels.	Rye, Bushels.	Ind. Corn. Bushels.	Oats, Bushels.	Peas and Bea. Bu.	Potatoes, Bushels.	Barley, Bush'ls.	Wool, Pounds.
Addison,	103,434	20,096	175,478	211,385	26,355	318,421	149	622,594
Bennington,	6,973	17,270	150,920	177,511	3,150	200,013	3,003	221,679
Caledonia,	62,551	2,090	96,389	218,735	6,419	565,341	3,658	136,790
Chittenden,	36,491	25,566	198,598	184,752	10,390	383,113	682	185,215
Essex,	8,826	1,360	21,931	45,597	2,506	94,124	1,221	29,614
Franklin,	55,488	9,138	137,896	145,840	10,255	258,757	815	209,350
Grand Isle,	31,324	3,986	23,245	81,027	10,469	31,793	739	70,291
Lamoille,	14,466	6,663	66,017	90,434	4,351	278,252	629	49,053
Orange,	52,822	9,740	176,586	205.457	5,658	599,925	1,861	248,715
Orleans,	58,515	4,853	70,306	169,587	3,723	407,132	8,974	81,947
Rutland,	25,874	20,598	258,831	183,706	4,220	416,000	627	623,199
Washington,	30,580	10,567	133,477	208,554	4,954	446,551	865	153,843
Windham,	8,749	18,302	210,141	160,393	2,279	338,295	14,124	179,122
Windsor,	39,862	26,004	312,581	224,756	9,920	613,297	4,803	589,305
Aggregate,	535,955	176,233	2,032,396	2,307,734	104,649	4,951,014	42,150	3,400,717

PRODUCE OF THE YEAR ENDING JUNE 1, 1850.

COUNTIES.	Buckwh't Bushels.	Orchard Produce.	Wine, Gal's.	Pro. Mar. Garden.	Butter, Pounds.	Cheese, Pounds.	Hay, Tons.	Clo.S. Bush.	Gr. Se'd Bush'ls.
Addison,	15,659	$41,696	114	$	876,771	817,149	88,793	5	1,589
Bennington,	22,797	16,629	7	1,558	502,786	558,494	54,600		622
Caledonia,	14,380	26,094	47	355	1,206,272	121,602	59,449	179	2,991
Chittenden,	10,003	33,841	303	10,913	838,481	1,663,456	57,407	2	619
Essex,	15,400	4,523			292,615	122,321	14,972	38	923
Franklin,	10,095	19,429		107	1,399,455	1,196,660	78,619		1,050
Grand Isle,	12,140	11,223		12	93,225	26,793	6,980	1	300
Lamoille,	10,373	9,095	94		437,110	213,035	26,973	9	587
Orange,	28,942	23,980		270	869,042	428,876	70,549	206	609
Orleans,	15,305	5,920			645,160	68,092	45,288	39	1,798
Rutland,	12,051	38,457	19	537	1,120,814	1,930,047	103,950	1	773
Washington,	10,135	20,620		1,475	970,368	437,476	54,959	37	767
Windham,	7,531	19,139	15	581	1,144,653	469,728	84,749	76	392
Windsor,	25,006	44,609	60	3,045	1,741,228	667,105	118,865	167	1,916
Aggregate,	209,819	315,255	659	18,853	12,137,980	8,720,834	866,153	760	14,936

PRODUCE OF THE YEAR ENDING JUNE 1, 1850.

COUNTIES.	Hops, Pounds.	Flax, Pounds.	Fl'x S'd Bush.	Silk Co. Pounds.	Map. Sugar, Pounds.*	Molas. Gall's.	Wax and Hon. lbs.	Ho. Manufac. Val.	Ani. Slaughtered. Value.
Addison,	5,962	1,282	51	76	205,263	650	40,654	$9,648	$176,856
Bennington,	193	2,522	132		220,009	165	14,814	6,450	86,123
Caledonia,	1,422	2,365	113		854,820	364	22,863	40,343	135,537
Chittenden,		968	26	4	242,842	70	18,319	13,359	134,536
Essex,	28,250	855	11		145,041	129	3,855	22,044	37,020
Franklin,	1,610	1,052	33		684,511	36	20,536	26,247	141,682
Grand Isle,		331	8	30	32,665		4,866	3,449	19,967
Lamoille,	15,657	1,293	41		427,918	23	11,501	6,584	80,296
Orange,	23,827	3,752	158	15	532,156	674	12,438	27,346	160,430
Orleans,	77,605	660	140		656,883		6,461	16,422	86,672
Rutland,	162	986	22		492,664		37,370	12,620	184,251
Washington,	12,125	2,730	31		765,429	407	17,299	17,269	155,477
Windham,	41,510	518	10	1	470,934	1,360	7,255	13,321	189,095
Windsor,	79,700	1,538	163	142	618,222	2,119	31,191	52,608	273,394
Aggregate,	288,023	20,852	939	268	6,349,357	5,997	249,422	267,710	1,861,336

***By comparing the amount of Maple Sugar here given, with amount made in 1840, as stated in Part I, page 210, it will be seen that the advance in the annual manufacture of this article, amounts to 1,701,423 pounds. There has also been a very great improvement in the quality of the sugar made as well as increase in quantity. Two *prize Medals* were awarded at the World's Fair, in London, in 1851, for Vermont Sugar, one to Mr. L. Dean, of Manchester, and the other to Mr. W. Barnes, of Rutland.**

PRODUCTIONS OF INDUSTRY IN THE YEAR ENDING JUNE 1; 1850.

COUNTIES.	No. of Estab.	Capital Invested.	Value of raw Material	No. of Hands.		Monthly Wages.		Value of Ann. Prod.
				Male.	Fema.	Male.	Female.	
Addison,	161	$289,375	$360,069	523	74	$12,143	$ 704	$659,838
Bennington,	150	468,050	414,622	652	117	15,137	1,077	880,216
Caledonia,	243	444,180	399,427	742	74	18,633	869	799,053
Chittenden,	202	771,610	700,192	848	368	19,211	3,121	1,320,730
Essex,	32	31,250	23,589	55		1,235		48,794
Franklin,	112	147,710	126,879	364	30	7,133	247	285,697
Grand Isle,	9	13,100	1,790	47		675		15,600
Lamoille,	45	110,300	93,108	115	31	2,909	421	175,861
Orange,	85	171,045	110,774	226	27	5,122	244	219,165
Orleans,	68	64,450	60,148	116	9	2,188	73	119,036
Rutland,	276	828,975	490,507	1,280	99	30,703	957	1,284,756
Washington,	77	231,337	223,705	375	74	9,656	784	525,236
Windsor,	196	476,720	399,933	649	273	15,345	3,601	831,209
Windham,	193	953,275	767,809	902	375	25,976	5,365	1,405,729
Aggregate,	1,849	5,001,377	4,172,552	6,894	1,551	166,066	17,463	8,570,920

REAL AND PERSONAL ESTATE IN VERMONT.

Valuation of Real and Personal Estate, by Assessors, - - - -	$71,671,651
Estimated true value of Real and Personal Estate, - - - - -	92,205,049

TAXES.

General State Tax, - - - - - - - - - - -	$138,533
School Tax, - - - - - - - - - - - - - -	88,930
Poor Tax, - - - - - - - - - - - - - -	90,809
County, Town, &c., Taxes, - - - - - - - - -	401,142
Total, - - - - - - - - - - - -	$719,414

WAGES.

Average Monthly Wages of a Farm Hand, - - - - - -	$13,00
" to a Day Laborer, with Board, - - - - - - -	0,72
" to a Day Laborer, without Board, - - - - - -	0,97
" Day Wages to a Carpenter, without Board, - - - -	1,44
Weekly Wages to a Female Domestic, with Board, - - - -	1,19
Price of Board to Laboring Men, - - - - - - - - -	1,95

PAUPERISM.

	Native.	Foreign.	Total.
Whole No. of Paupers within the year ending June 1, 1850, -	2043	1611	3654
Whole No. of Paupers on June 1, 1850, - - - - -	1565	314	1879

CRIME.

	Native.	Foreign.	Total.
Whole No. of Criminals convicted within the year ending June 1, 1850, - - - - - - - - - - - - - - -	34	45	79
Whole No. in Prison on June 1, 1850, - - - - - - -	64	41	105

RAIL ROADS IN VERMONT.

At the time of the publication of our History of Vermont in 1842, we had neither canals nor rail roads within the state; but we ventured the opinion, (Part I, page 217) that Boston would in time be connected with Lake Champlain by a continuation of the Lowell and Concord rail road. At that time we little thought that the short period of ten years would witness the completion of a net-work of rail road over the whole country. Ten years ago the construction of a railway across the Green Mountains from the valley of the Connecticut to Lake Champlain, was very generally regarded as a chimerical notion, which would never be realized, and they who entertained it were looked upon as visionaries. But events have proved it otherwise. We have already two rail roads crossing the state from east to west, connecting these vallies; and, also a road in each of these vallies running north and south, through nearly the entire length of the state.

The first rail road commenced in this state was the Vermont Central, and the ground was first broken for the construction of that road in the spring of 1846 at Windsor. The Rutland and Burlington road was commenced in the spring of 1847, and both of these roads were opened from Connecticut river to Burlington in December, 1849.

The following table exhibits the names, the terminations, the lengths, and the times of opening the several rail roads, in operation in April, 1853.

NAMES.	TERMINATIONS.		LENGTH.	OPENED.
Atlantic and St. Lawrence,*	Bloomfield,	Norton,	34	1853
Conn. and Passumpsic Rivers,	White River,	St. Johnsbury,	61	1851
Rutland and Burlington,	Burlington,	Bellows Falls,	119	1849
Rutland and Washington,	Rutland,	Poultney,	18	1852
Rutland and Whitehall,	Castleton,	Whitehall,	12	1850
Vermont Central,	Burlington,	Windsor,	117	1849
Vermont and Canada,	Essex Junction,	Rouse's Point,	47	1850
Vermont and Massachusetts,	Brattleborough,	South Vernon,	10	1849
Vermont Valley,	Bellows Falls,	Brattleborough,	24	1851
Western Vermont,	Rutland,	N. Bennington,	51	1852
			493	

Several others are in contemplation within the state, and no great length of time will probably elapse before the Connecticut and Passumpsic Rivers road will be continued northward from St. Johnsbury to Canada Line. The effects which these roads have produced upon the towns through and near which they pass, are marked and obvious, but I have not room to particularize them.

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*This is a section of the rail way designed to connect Portland, Me , with Montreal, C. E. It is now opened (April, 1853,) from Portland to Island Pond in Brighton and from Montreal to Sherbrooke. The intermediate portion from Sherbrooke to Island Pond is nearly ready for the rails and is expected to be opened in the course of a few months. The length here given is only an estimate from the Map.

MAGNETIC TELEGRAPH.

The Magnetic Telegraph, which seems to be essential to the safe management of rail roads, sprang into being very soon after the time when railroads themselves had their origin; and they were introduced simultaneously into Vermont. The first line of telegraph in Vermont, forms a part of the *Troy and Canada Junction Line,* and was commenced in 1847. It was opened for communication, from Troy to Burlington, on the 2d of Feb. 1848, and was soon after carried through to Montreal. This line enters the state at Bennington, passes thro' Manchester, Rutland, Castleton, Whitehall, Orwell, Brandon, Middlebury, Vergennes, Burlington and St. Albans, and leaves the state at Highgate. The length of this line, within the state, is 200 miles.

The Northern Telegraph Line connects Boston with Rutland. Proceeding from Boston by way of Fitchburg and Keene it enters the state at Bellows Falls and follows the line of the Rutland and Burlington rail road through Chester and Ludlow to Rutland. Length within the state 50 miles.

Vermont and Boston Telegraph Line.—Proceeding from Boston by way of Lowell and Concord, this line enters the state at White River Junction, and, after going to Woodstock and back, 20 miles, follows the line of the Central rail road, passing thro' South Royalton, West Randolph, Northfield Montpelier, Waterbury, and Essex Junction to Burlington. From Burlington it follows the Vermont and Canada rail road through St. Albans and Swanton to Rouse's Point, where it leaves the state, and proceeds in two branches, one to Montreal and the other to Ogdensburgh. Connected with this line and crossing it at White River Junction, the same company have a line along the valley of the Connecticut, reaching from St. Johnsbury to Springfield, Mass. From St. Johnsbury it follows the rail road through Newbury and Bradford to Norwich, where it crosses over to Hanover and back, and then proceeds down to White River Junction. From the Junction it proceeds to Windsor, crosses over to Claremont, N. H., then back to Weathersfield Bow, thence to Springfield—then by way of Charlestown bridge to Charlestown, and down the Sullivan rail road to Bellows Falls. From Bellows Falls it proceeds down the Connecticut on the Vermont side thro' Brattleborough into Massachusetts. The whole length of telegraph line belonging to this company is about 700 miles, of which more than 300 are in Vermont. The whole length of telegraph wire in the state is little less than 600 miles, and the cost of building, including appurtenances and patent privileges has been about $215 per mile.

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